Supplemental Environmental Analysis
For Purposes of
2003-2004 Dredging
(Lower Snake and Clearwater Rivers, Washington and Idaho)

Attachment A

Biological Assessment
For Anadromous Fish Species

2003-2004 ROUTINE MAINTENANCE DREDGING
IN THE LOWER SNAKE RIVER RESERVOIRS

BIOLOGICAL ASSESSMENT
FOR ANADROMOUS FISH SPECIES

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Prepared In Compliance with
The Endangered Species Act

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1.0 INTRODUCTION

The U.S. Army Corps of Engineers, Walla Walla District (Corps), is proposing to conduct navigation and maintenance dredging on the lower Snake River and at the mouth of the Clearwater River during the winter in-water work window of 15 December 2003 to 1 March 2004 (2003-2004). The proposed activities would occur in the states of Washington and Idaho, and include dredging and dredged material disposal. The purpose of the dredging is to restore the navigation channel to its authorized depth for navigation and safety reasons, restore a portion of the flow conveyance in the Lewiston-Clarkston area, and restore access to port and other public use areas.

As part of this environmental review process, the Corps has developed a Biological Assessment (BA) of the potential impacts of project actions to species listed under the Endangered Species Act (ESA). For the purposes of this BA, only anadromous fish species are evaluated. The Corps has identified four Federally listed species that occur, or may occur, in the project vicinity. These include: Snake River sockeye salmon (*Oncorhynchus nerka*), Snake River fall chinook salmon (*O. tshawytscha*), Snake River spring/summer chinook salmon (*O. tshawytscha*), and Snake River basin steelhead (*O. mykiss*).

The lower Snake River supports a limited population of bull trout (*Salvelinus fontinalis*) on a seasonal basis, and the Corps recognizes the potential for this species to exist in the anadromous form. However, consultation for bull trout will be performed with the U.S. Fish and Wildlife Service (USFWS). In addition, two anadromous species of concern may be found in the project area. These include Pacific lamprey (*Lampetra tridentata*) and white sturgeon (*Acipenser transmontanus*).

2.0 PROJECT DESCRIPTION

2.1 Background and Purpose

The Corps is authorized by the River and Harbor Act of 1945 (Public Law 79-14) to maintain a navigation system on the lower Snake and Columbia Rivers. The portion of the navigation system within the Walla Walla District includes five reservoirs that are part of the Columbia/Snake River inland navigation waterway, which provides slackwater navigation from the mouth of the Columbia River near Astoria, Oregon, to port facilities on the Snake and Clearwater Rivers at Lewiston, Idaho, and Clarkston, Washington. The Corps has used some level of dredging on a periodic basis in each of these reservoirs to maintain the navigation channel at the authorized depth of 14 feet [4.3 meters (m)].

There are four locks and dams on the portion of the Snake River navigation project in the 2003-2004 dredging area: Ice Harbor Lock and Dam (Ice Harbor), Lower Monumental Lock and Dam (Lower Monumental), Little Goose Lock and Dam (Little Goose), and Lower Granite Lock and Dam (Lower Granite). Each of these projects is authorized to provide navigation facilities including locks with dimensions of 86 feet

(26.2 m) wide and over 665 feet (202.7 m) long, to allow passage of a tug with the four-barge tow commonly used in river navigation. Construction of these dams created a series of slackwater reservoirs on the Snake River, adding an additional 140 miles [225.4 kilometers (km)] to the Columbia/Snake River shallow-draft inland navigation system. This navigation system has resulted in a significant increase in the economy of eastern Washington and Idaho, as new inland ports have become established to handle the needs of barge shippers. Wheat, barley, wood chips, and other wood products are the primary commerce bound downstream from this region, with petroleum and fertilizer the principal commerce bound upstream. Over the years, the navigation industry has grown to depend on the availability of a navigation system that provides a 14-foot (4.3-m) draft channel for barge tows.

Lower Granite, the most upstream of the four lower Snake River dams, is the predominant sediment collection area for a large sediment-contributing drainage that includes the upper Snake, Salmon, Grande Ronde, Imnaha, and Clearwater Rivers. The quantity of sediment that annually collects in the Lower Granite reservoir far exceeds quantities observed to collect in any of the other lower Snake River reservoirs. The upper reach of the Lower Granite reservoir serves as a sediment trap for most of the material carried in suspension in the free-flowing reaches of the contributing tributaries.

The Lower Granite project includes levees as appurtenant facilities of the authorized project to allow normal operating water surfaces of 733 to 738 feet above mean sea level (fmsl) in the Lewiston and Clarkston areas. Although flood control was not a primary purpose of this project, the backwater levees constructed around Lewiston were designed to protect the city from inundation during the occurrence of a Standard Project Flood (SPF) of 420,000 cubic feet per second (cfs) [11,893.1 cubic meters per second (m^3/s)]. However, an accretion of sedimentation at the confluence of Snake and Clearwater Rivers has reduced this level of protection. Dredging the confluence area will restore a portion of this lost protection.

The Corps also maintains recreation facilities as part of the lock and dam projects. Boat launch facilities and swimming beaches at the recreation sites have periodically been dredged to remove accumulated sediment that reduces water depth and interferes with recreational use. For the purpose of this document, boat basins are defined as the turning area at recreational launches where boats are typically staged prior to entering the river, as opposed to marinas where boats are typically moored for long periods.

2.2 History of Corps Dredging in the Lower Snake and Clearwater Rivers

A history of Walla Walla District dredging in the Lower Snake and Clearwater Rivers is shown in Table 1. Although several dredging locations proposed for 2003-2004 have been dredged since salmon stocks were first listed under the ESA, National Marine Fisheries Service (NMFS) [also called National Oceanic and Atmospheric

Administration Fisheries (NMFS)][1] and other agencies believe that negative impacts on listed species may occur in the project area during the established in-water work window. These species primarily include juvenile Snake River fall chinook salmon and Snake River Basin steelhead.

The Corps last dredged the Snake/Clearwater Rivers confluence area and Lower Granite navigation lock approach in 1997-1998, and the Lower Monumental navigation lock approach in 1998-1999. Both times, the Corps used in-water disposal and, both times, the Corps made a "*May Affect, But Not Likely To Adversely Affect*" determination with which the NMFS' Snake River Basin Habitat Office in Boise, Idaho, concurred.

Table 1. History of Dredging in the Lower Snake and Clearwater Rivers

Dredge Location	Year	Purpose	Amount Dredged (cy)	Disposal
Excavation of Navigation Channel Ice Harbor Lock and Dam Part I and II, Channel Construction	1961	Navigation	3,309,500	Unavailable
Navigation Channel Ice Harbor Lock and Dam Part III, Channel Construction	1962	Navigation	120,000	Unavailable
Downstream Navigation Channel Ice Harbor Lock and Dam	1972	Navigation	80,000	Unavailable
Downstream Approach Navigation Channel Lower Monumental Lock and Dam	1972	Navigation	25,000	Unavailable
Navigation Channel Downstream of Ice Harbor Lock and Dam	1973	Navigation	185,000	Unavailable
Downstream Approach Channel Construction Lower Monumental Lock	1977	Navigation	10,000	Unavailable
Downstream Approach Channel Construction Ice Harbor Lock	1978	Navigation	110,000	Unavailable
Downstream Approach Channel Construction Ice Harbor Lock	1978/ 81/82	Navigation	816,814	Unavailable
Recreation Areas (Corps)	1975 – Present	Recreation	20,000	Upland Sites
Clearwater River Port of Lewiston Area (Corps)	1982	Navigation/ Maintain Flow Conveyance Capacity	256,175	Upland Sites
Port of Clarkston (Port)	1982	Navigation	5,000	Upland Site

[1] Prior to 2003, NOAA Fisheries was known as National Marine Fisheries Service (NMFS). While we have tried to maintain consistency throughout this document by adhering to the naming conventions used during the particular time period under discussion, it may be assumed that the terms "NMFS" and "NOAA Fisheries" are interchangeable in this document, and refer to the same organization.

Table 1. History of Dredging in Lower Snake and Clearwater Rivers (continued).

Dredge Location	Year	Purpose	Amount Dredged (cy)	Disposal
Downstream Approach Channel Construction Ice Harbor Lock	1985	Navigation	98,826	In-Water
Snake/Clearwater Rivers Confluence Area (Corps)	1985	Maintain Flow Conveyance Capacity	771,002	Wilma HMU
Port of Lewiston (Corps)	1986	Navigation/ Maintain Flow Conveyance Capacity	378,000	Upland Sites
Snake/Clearwater Rivers Confluence Area (Corps)	1988	Maintain Flow Conveyance Capacity	915,970	In-Water
Snake/Clearwater Rivers Confluence Area (Corps)	1989	Maintain Flow Conveyance Capacity	993,445	In-Water
Schultz Bar (Corps)	1990	Navigation	27,335	NA
Snake/Clearwater Rivers Confluence Area (Corps)	1992	Maintain Flow Conveyance Capacity	520,695	In-Water
Ports of Lewiston, Almota, and Walla Walla	1991/92	Navigation	90,741	Unavailable
Schultz Bar (Corps)	1995	Navigation	14,100	In-Water
Snake/Clearwater Rivers Confluence Area (Corps)	1996/97	Navigation	68,701	In-Water
Snake/Clearwater Rivers Confluence Area (Corps)	1997/98	Navigation	215,205	In-Water
Greenbelt Boat Basin Clarkston	1997/98	Navigation	5,601	In-Water
Port of Lewiston (Port)	1997/98	Navigation	3,687	In-Water
Port of Clarkston (Port)	1997/98	Navigation	12,154	In-Water
Lower Granite Navigation Lock Approach	1997/98	Navigation	2,805	In-Water
Lower Monumental Navigation Lock Approach	1998/99	Navigation	5,483	In-Water
Source: USFWS, August 1998/Corps, July 19, 1995, and September 2, 1999.				

2.3 The Dredged Material Management Plan/Environmental Impact Statement (DMMP/EIS)

The 2002 DMMP/EIS, following Corps policy guidance[2], evaluated navigation maintenance needs over a 20-year timeframe to determine cost effective, environmentally acceptable, and beneficial management of dredged material for the McNary and lower Snake River projects. The 2002 DMMP/EIS also describes the short-term needs specifically outlined as planned 2002-2003 dredging activities in Appendix N of the report.

The analyses included effects on various environmental resources[3] and alternatives[4] and measures[5] were discussed. These measures included, but were not limited to, sediment reduction measures such as changing upstream land uses and sediment controls, reservoir drawdown to flush sediments with higher velocity flows, and various dredging and non-dredging measures.[6] Various disposal options associated with dredging were also evaluated, including in-water disposal for the creation of improved fish habitat[7] and levee raising measures (to increase flow conveyance in the Lower Granite reservoir).[8]

These various measures were further "screened," based on a set of evaluation criteria[9] ranging from cost effectiveness to environmental impacts. This evaluation process resulted in the removal of some measures from further consideration, while other alternatives were carried forward that were considered reasonable and feasible and within the stated purpose and need. Each of the alternatives formulated retained maintenance dredging as a primary measure.

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[2] The rationale for the development of dredging plans is set forth in Corps regulation, ER 1105-2-100(8) (Corps, 2000), which states that dredged material management planning for all Federal harbor projects is conducted by the Corps to ensure that maintenance dredging activities are performed in an environmentally acceptable manner, use sound engineering techniques, are economically warranted, and that sufficient confined disposal facilities are available for at least the next 20 years. These plans address dredging needs, disposal capabilities, capacities of disposal areas, environmental compliance requirements, potential for beneficial usage of dredged material, and indicators of continued economic justification. Ultimately, the plan's purpose is the management of sediment from an authorized project and, if possible, the reduction of the volume of sediment that requires management.

[3] 2002 DMMP/EIS, Section 3, *Affected Environment*

[4] 2002 DMMP/EIS, Section 2, *Alternatives*

[5] 2002 DMMP/EIS, Section 2.2, *Measures Considered*

[6] 2002 DMMP/EIS, Section 2.2, *Measures Considered*

[7] 2002 DMMP/EIS, Section 2.2.4.1, *Dredging With In-Water Disposal*; and Section 2.8.5.1, *Beneficial Use Option*

[8] 2002 DMMP/EIS, Section 2.8.6, *Levee Raise*

[9] 2002 DMMP/EIS, Section 2.3*, Formulation of Alternatives to be Considered in Detail*; and Section 2.3.1, *Screening Process*

- ***National Wildlife Federation v. National Marine Fisheries Service et al.***

The 2002 DMMP/EIS was developed in cooperation with EPA and was completed in July 2002. The Corps signed a Record of Decision (ROD) in September 2002 and awarded a contract for the 2002-2003 dredging activity. Mobilization had begun when the National Wildlife Federation *et al.*[10] filed a lawsuit and a motion for preliminary injunction in November 2002, against the Corps and NMFS, challenging the adequacy of the 2002 DMMP/EIS and the 2002 Biological Opinion.

Several groups, a tribe, and others joined the lawsuit. The Lower Granite Navigation Coalition,[11] filed a motion to intervene in November 2002, to protect interests in the continued navigability and operation of the Snake River system. The Nez Perce Tribe participated in an *amicus curiae* status, citing as reasons their interest in fish and wildlife and cultural resources, supporting the plaintiffs' request for declaratory and injunctive relief.

On December 12, 2002, the U.S. District Court, Western District of Washington, granted plaintiffs' motion for preliminary injunction. The Court enjoined the Corps from initiating dredging or disposal activities in the lower Snake River, as set forth in the 2002 DMMP/EIS and ROD, and NMFS from authorizing incidental take of ESA-listed species for the DMMP project until such time as the Court rules on the merits of plaintiffs' claims.

On April 17, 2003, the parties in this litigation asked the Court to stay the case in a joint status report. The Corps then decided to withdraw the September 2002 ROD, and NMFS decided to withdraw their BIOP for the DMMP.

This BA is part of the Corps' plans to initiate a concurrent and separate process to develop the documents necessary under the National Environmental Policy Act (NEPA), ESA, and other applicable laws, to determine whether it may conduct routine maintenance dredging in 2003-2004. The process for the short-term maintenance dredging includes the preparation of a Supplemental Environmental Analysis for Purposes of 2003-2004 Dredging (SEA-03/04), a BA, biological opinion, and any other required activities relating to 2003-2004 dredging. The 2002-2003 dredging areas described and analyzed in the July 2002 DMMP/EIS are the same areas proposed for dredging in 2003-2004. The Corps will include a 30-day public review period of the documents before signing a decision document.

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[10] Washington Wildlife Federation, Idaho Wildlife Federation, Idaho Rivers United, Pacific Coast Federation of Fishermen's Associations, and Institute for Fisheries Resources

[11] Lewis-Clark Terminal, Inc., Cargill/Louis Dreyfus, Port of Benton, Port of Clarkston, Port of Kennewick, Port of Lewiston, Port of Morrow, Port of Pasco, Port of Umatilla, Port of Walla Walla, Port of Whitman County, Shaver Transportation Company, and Potlatch Corporation

2.4 The Proposed 2003-2004 Dredging

The following are descriptions of dredging activities planned for the in-water work window of 2003-2004 (see Table 2). There are no dredging templates for the public-use sites, but dredging in the boat basins would attempt to restore the original design contours and depths of the boat basins. Note that, within those dredging templates defined in the federal navigation channel, material will only be removed at those locations where sediments have accumulated and raised the bottom elevation to the point that available water depths are less than 16 feet when the reservoir water surface elevation is at MOP. A 16-foot depth is used as the maximum dredging depth in the Federal navigation channel, in order to maintain a consistent 14-foot depth. Of the additional 2 feet, 1 foot is defined as advance maintenance (the additional depth and/or width specified to be dredged beyond the project channel dimensions for the purpose of reducing overall maintenance costs and impacts by decreasing the frequency of dredging), and 1 foot is defined as allowable overdepth (additional depth below the required section specified in a dredging contract, and permitted because of inaccuracies in the dredging process) (Corps, 1991). This overdepth dredging is standard procedure,[12] and helps prevent the need for more frequent and intermittent dredging of high spots. Other public use areas are dredged to depths based on their specific needs.

Table 2. Sites Proposed for Dredging in 2003-2004 and the Estimated Quantities for Each.

Site Number	Site to be Dredged	Quantity to be Dredged (cy)	Total Surface area of site (Acres)	Predominant Sediment Type* (Percent)
1	Federal Navigation Channel at Confluence of Snake and Clearwater Rivers	250,500	63.2	Sand (85-90%)
2a	Port of Clarkston	9,600	0.9	Silt (90%)
2b	Port of Lewiston	5,100	1.8	Silt (90%)
3a	Greenbelt Boat Basin	2,800	1.0	Sand (45%) Silt (35%)
3b	Swallows Swim Beach/Boat Basin	16,000	2.2	Sand (56-67%) Silt (21-27%)
3c	Lower Granite Dam Navigation Lock Approach	4,000	1.5	Cobble/Rock (100%)
3d	Lower Monumental Dam Navigation Lock Approach	20,000	6.06	Rock/Cobble (100%)
4a	Illia Boat Launch	1,400	1.0	Silt (86-95%)
4b	Willow Landing Boat Launch	6,200	1.4	Sand (56-67%) Silt (21-27%)
		315,600[1]	**79.06[2]**	

[1]2000 Data. These figures are representative of the estimated 2003-2004 dredging quantities.
[2]The area impacted by dredging is less than 0.5 percent of the total surface area of the lower Snake River reservoirs affected. This very small percentage indicates the relative scale of the area impacted by dredging when compared with the total available aquatic habitat area.

[12] Engineer Regulation 1130-2-307, *Dredging Policies and Practices, Interim Guidance*, Section 7.1., *Project Dimensions*.

2.4.1 Site 1 - Confluence of Snake and Clearwater Rivers (Federal Navigation Channel)

The Corps anticipates dredging up to 250,500 cubic yards (cy) [191,521.0 cubic meters (m^3)] of material from the Federal navigation channel at the confluence of the Snake and Clearwater Rivers in the winter of 2003-2004. Dredging would be aimed at restoring the navigation channel to a depth of no more than 16 feet (4.9 m) in the area designated in plate 1. Dredging has occurred in this area since 1985; and conveyance dredging[13] was done in 1988, 1989, and 1992. Sediment surveys in June 2000 discovered that 85 to 90 percent of the substrate at this location was sand and 10 to 15 percent was silt and/or organic material. Dredging this area is expected to remove approximately 63.2 surface acres (25.6 hectares), or 12.5 percent of sandy shallow-water thalweg habitat from the nearly 500-acre bank-to-bank confluence area (see Figure 1). This habitat is used by salmonids primarily for migration throughout the water column.

Bennett *et al.* (1997) reported that juvenile fall chinook salmon in Lower Granite reservoir prefer sandy substrates, but typically along shorelines. Most dredging in this area would be done in the thalweg of the river and would avoid the shoreline areas. Therefore, in-water sites known to provide rearing habitat for fall chinook salmon (*e.g.*, Port of Wilma) would not be disturbed. Long-term negative impacts to habitat used by threatened and endangered salmonids, including rearing, migratory, and overwintering behavior, are not anticipated at this dredging location.

2.4.2 Site 2a - Port of Clarkston

The Corps anticipates dredging up to 9,600 cy (7,339.7 m^3) of material from the Port of Clarkston in Winter 2003-2004. Dredging would be aimed at restoring the port to a depth of no more than 15 feet (4.9 m) in the area designated on plate 2. Dredging has occurred in this area since 1982, and it was last dredged in 1998. Sediment surveys in June 2000 discovered that sediment composition was more than 90-percent silt. Dredging at this location is expected to remove 0.9 acre (0.4 hectare) of shallow-water silt habitat.

Bennett *et al.* (1997) reported that juvenile fall chinook salmon in the Lower Granite reservoir prefer sandy substrates. The location of the port on the reservoir is such that it is a place that continually collects silt. Although Easterbrooks (1995-1998) found some chinook salmon overwintering in backwater areas of the Columbia River, dredging this area is expected to have little to no short- or long-term deleterious consequences to endangered fish habitat because it would occur during the winter in-water work window.

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[13] Conveyance dredging involves dredging both the navigation channel and areas outside the navigation channel [historically, up to 1,300 feet (396.24 m) in total width] in an attempt to enlarge the river cross section and increase the flow conveyance capacity of the river in that reach.

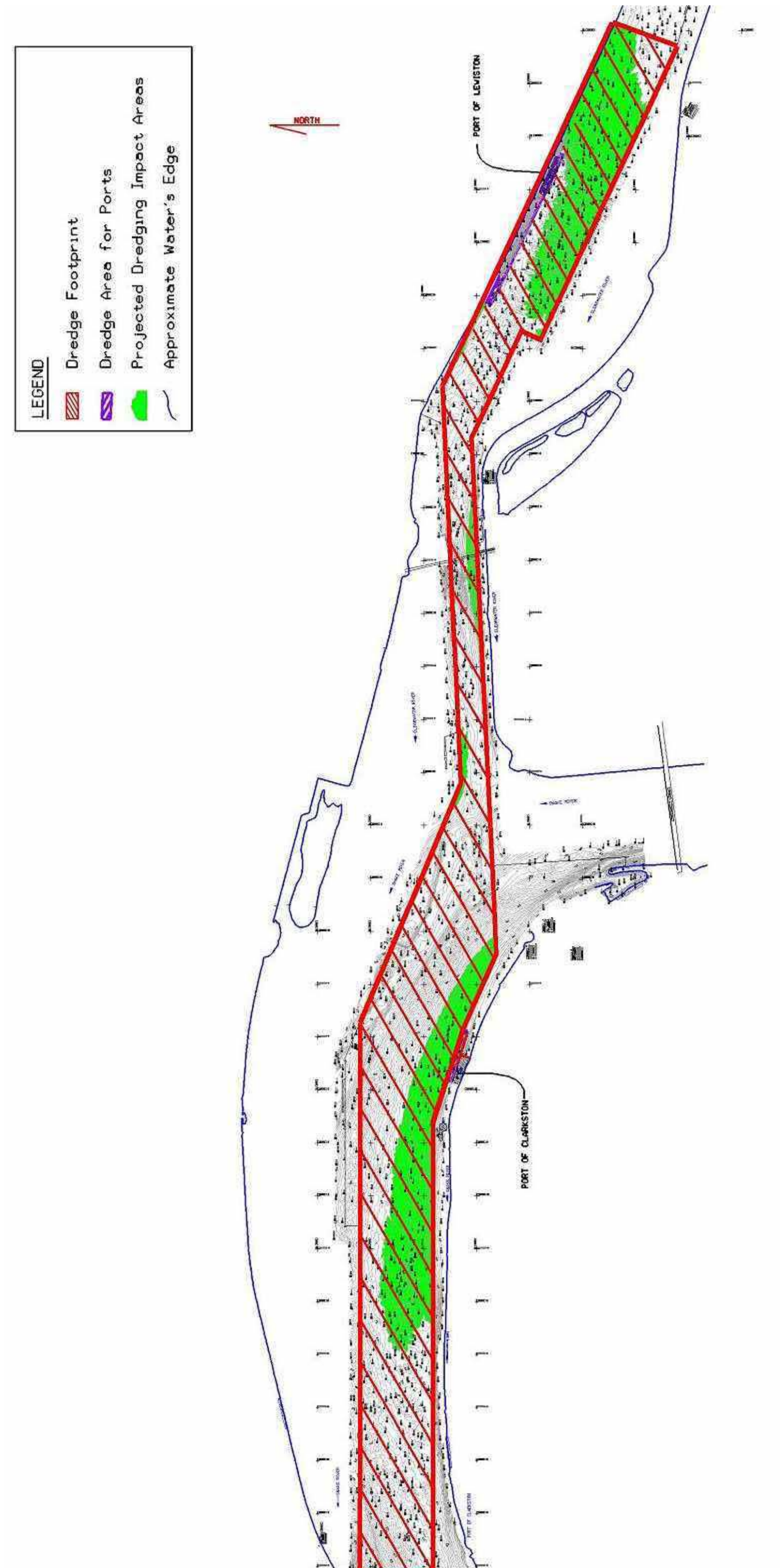


Figure 1. 2003-2004 Proposed Dredging Areas in the Federal Navigation Channel at the Confluence of the Snake and Clearwater Rivers

2.4.3 Site 2b - Port of Lewiston

The Corps anticipates dredging up to 5,100 cy (3,899.2 m^3) of material from the Port of Lewiston in Winter 2003-2004. Dredging would be aimed at restoring the port to a depth of no more than 15 feet (4.9 m) in the area designated on plate 3. Dredging has occurred in this area since 1982, and it was last dredged in 1998. Sediment surveys in June 2000 discovered that sediment composition was 90-percent silt. Dredging at this location is expected to remove 1.8 acres (0.7 hectare) of shallow-water silt habitat.

Bennett *et al.* (1997) reported that juvenile fall chinook salmon in Lower Granite reservoir prefer sandy substrates. The location of this port on the reservoir is such that it is a place that continually collects silt. Although Easterbrooks (1995-1998) found some chinook salmon overwintering in backwater areas of the Columbia River, dredging this area is not expected to have short- or long-term deleterious consequences to endangered fish habitat because it would occur during the winter in-water work window.

2.4.4 Site 3a - Greenbelt Boat Basin

The Corps anticipates dredging up to 2,800 cy (2,140.8 m^3) of material from the Greenbelt Boat Basin in Winter 2003-2004. Dredging would be aimed at restoring the basin to a depth of no more than 7 feet (2.1 m) in the area designated on plate 4. Dredging has occurred in this basin since 1975, and it was last dredged in 1998. Sediment surveys in June 2000 discovered that sediment composition was 45-percent sand and 35-percent silt. Although the template in plate 4 shows that up to 33.3 acres (13.5 hectares) of shallow-water sand and silt habitat would be removed, construction drawingss show that all dredging would occur between the shore and 25 yards (22.9 m) out and within 175 yards (160.0 m) downstream of the boat basin. Total acreage to be dredged is approximately 1 acre (0.4 hectare). With the closely-correlated ratios of silt to sand, the value of this habitat for rearing salmonids is not known. Some winter rearing habitat may be removed by dredging this area.

In 2002, Bennett (unpublished data—report in progress) found a notable number of juvenile salmonids at this location. Specifically, a total of 369 chinook, 10 sockeye, and 2 steelhead were collected, primarily in May and June of that year. However, since the work would be conducted during the winter when species are not likely to be present, it is anticipated that dredging this area would have only minor impacts to anadromous fish populations or their habitat.

2.4.5 Site 3b - Swallows Swim Beach/Boat Basin

The Corps anticipates dredging up to 16,000 cy (12,232.9 m^3) of material from the Swallows Swim Beach and Boat Basin in Winter 2003-2004. Dredging would be aimed at restoring the boat basin to a depth of no more than 8 feet (2.4 m), and the swim beach to a depth of no more than 5 feet (1.5 m), in the template outlined on plate 5. Dredging has occurred in this area since 1975, and it was last dredged in 1999. Sediment surveys in June 2000 discovered that sediment composition was 56- to 67-

percent sand and 21- to 27-percent silt. Dredging at this location is expected to remove no more than 2.2 acres (0.9 hectare) of shallow-water sand and silt habitat. With the closely correlated ratios of silt to sand, the value of this habitat for rearing salmonids is not known. Some winter rearing habitat would probably be removed by dredging this area.

In 2002, Bennett found a notable number of juvenile salmonids at this location. Specifically, a total of 89 chinook and 9 steelhead were collected, primarily in June of that year. However, because of the small size of the boat launch at Swallows, the large shallow waters adjacent and, given that dredging would occur during the winter in-water work window, it is anticipated that dredging this area would have only minor impacts to anadromous fish habitat or populations.

2.4.6 Site 3c - Lower Granite Dam Navigation Lock Approach

The Corps anticipates dredging up to 4,000 cy (3,058.2 m^3) of material from the Lower Granite Dam Navigation Lock Approach in Winter 2003-2004. Dredging would be aimed at restoring the navigation channel to a depth of no more than 16 feet (4.9 m) in the area designated on plate 6. Dredging has occurred in this area since 1975, and it was last dredged in 1998. Sediment surveys in June 2000 discovered that sediment composition was large rock substrate and 1- to 6-inch [2.5- to 15.2-centimeter (cm)] cobbles. Although the Navigation Lock Approach dredging template covers 28 percent of the tailrace area downstream from Lower Granite Dam, the total surface area to be dredged in the navigation lock approach in 2003-2004 comprises only 1.2 percent of the entire tailrace area. Dredging at this location is expected to remove 1.45 acres (0.59 hectares), or 1.2 percent of shallow-water rock and cobble habitat from the nearly 120-acre bank-to-bank tailrace area (see Figure 2).

Although adult fall chinook salmon have the potential to spawn in the existing navigation channel (where suitable substrate exists), no spawning is anticipated based on lower water velocities in this area. The tailrace of the dams were surveyed for redds each year between 1993 and 1997, and again in 2002. No redds were found in the Federal navigation channel (see Figure 3).

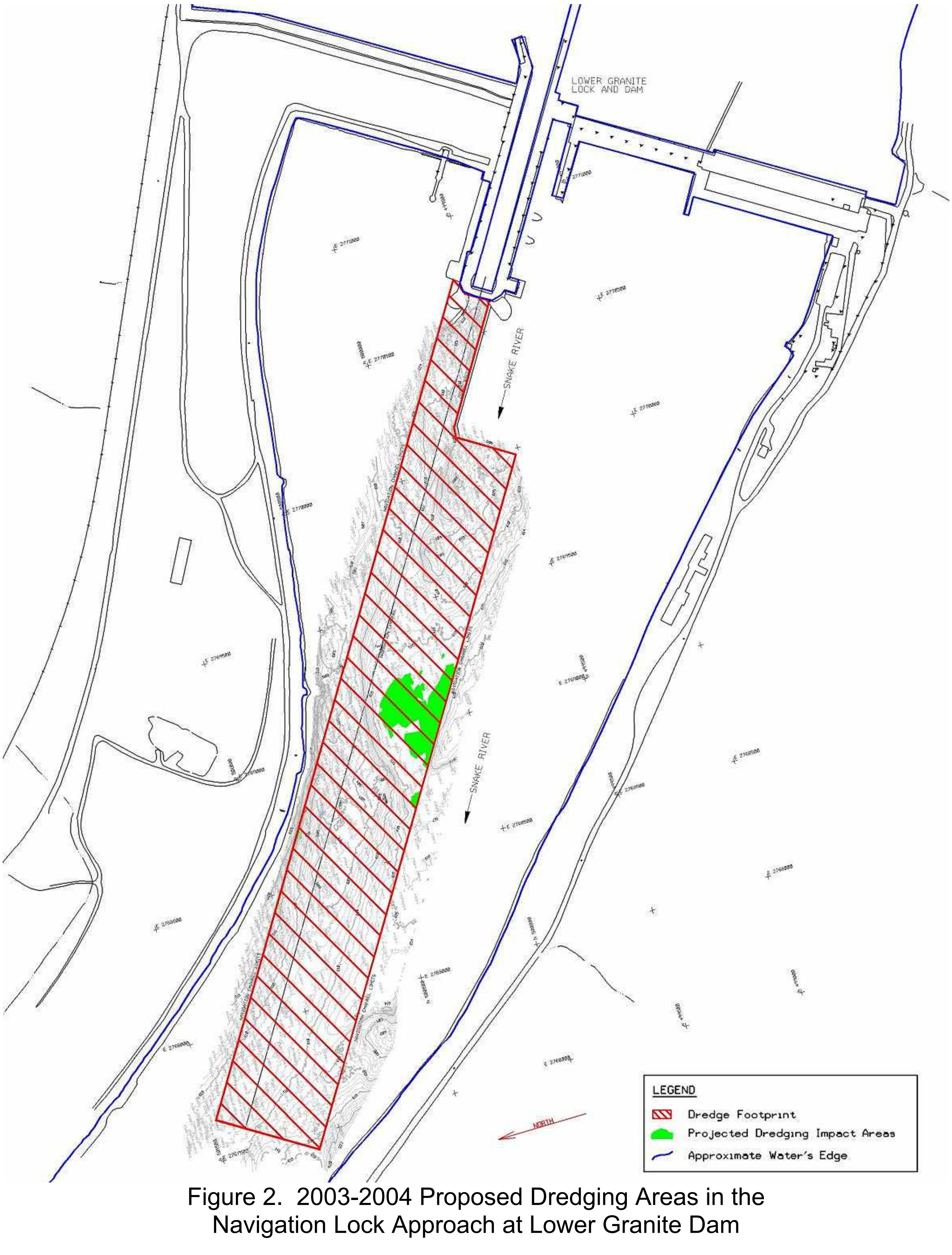


Figure 2. 2003-2004 Proposed Dredging Areas in the Navigation Lock Approach at Lower Granite Dam

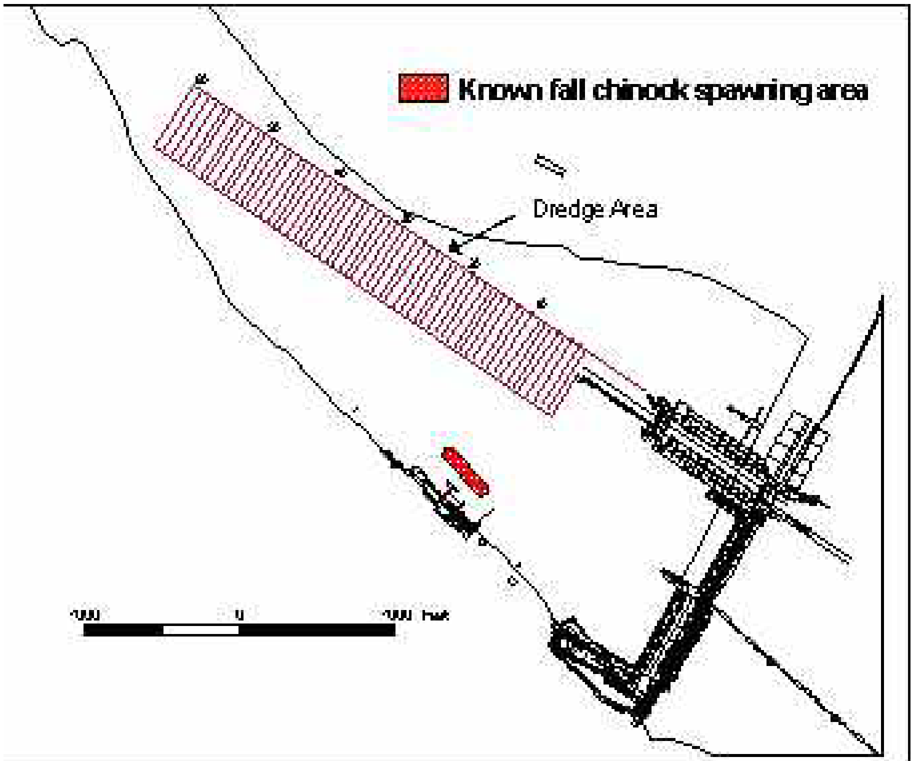


Figure 3. Lower Granite Tailrace showing the dredging footprint in the cross hatching and the only known spawning location in the dark patch.

2.4.7 Site 3d - Lower Monumental Dam Navigation Lock Approach

The Corps anticipates dredging up to 20,000 cy (15,291.1 m^3) of material from the Lower Monumental Dam Navigation Lock Approach in Winter 2003-2004. Dredging would be aimed at restoring the navigation channel to a depth of no more than 16 feet (4.9 m) in the area designated on plate 7. Dredging has occurred in this area since 1972, and it was last dredged in 1999. Sediment surveys in June 2000 discovered that sediment composition was large rock substrate and 1- to 6-inch (2.5- to 15.2-cm) cobbles. Although the navigation lock approach dredging template covers 26 percent of the tailrace area downstream from Lower Monumental Dam, the total surface area to be dredged in the navigation lock approach in 2003-2004 comprises only 3.4 percent of the entire tailrace area. Dredging at this location is expected to remove 6.06 acres (3.57 hectares), or 3.4 percent, of shallow-water rock and cobble habitat from the nearly 178-acre bank-to-bank tailrace area (see Figure 4).

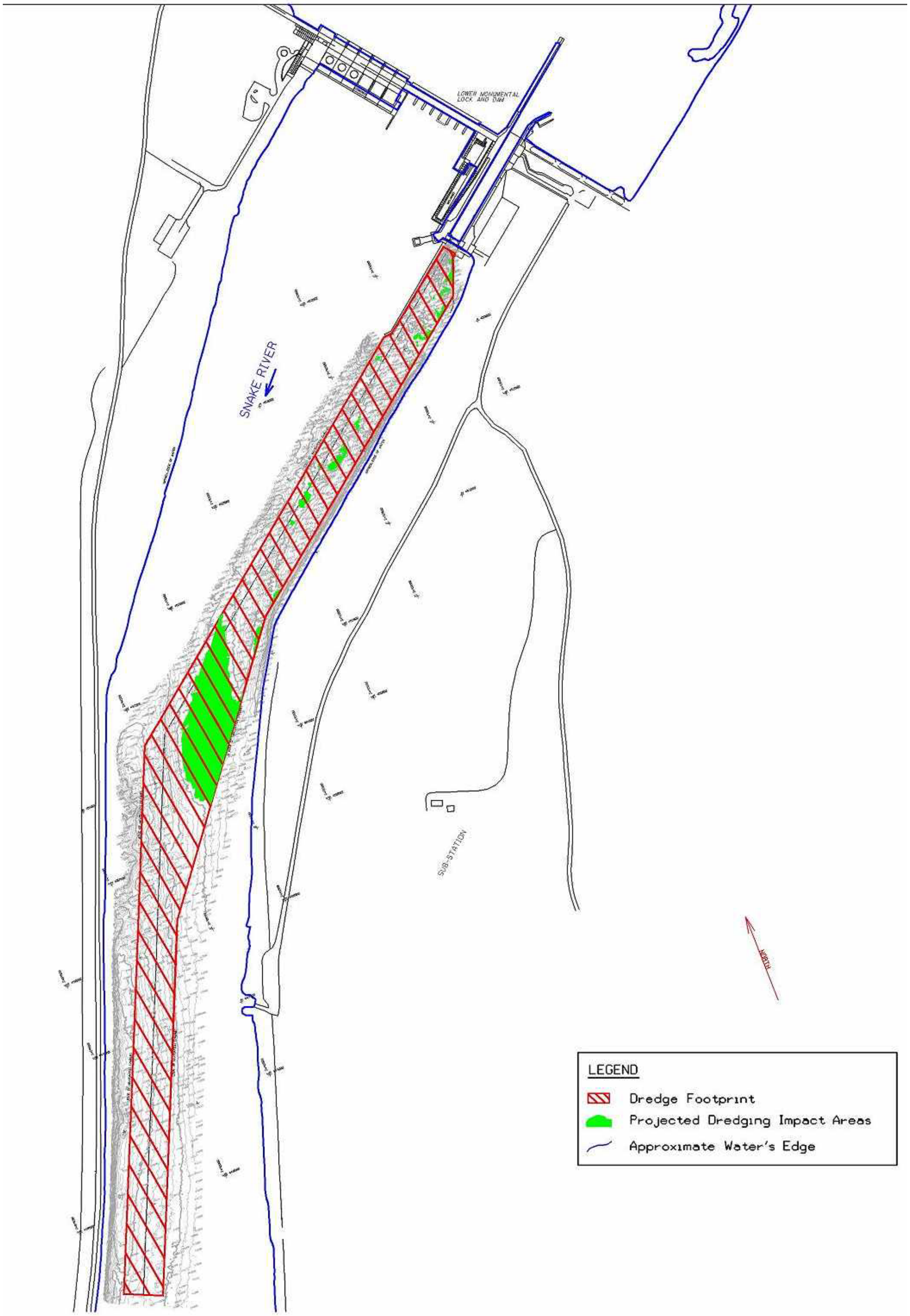


Figure 4. 2003-2004 Proposed Dredging Areas in the Navigation Lock Approach at Lower Monumental Dam

Although adult fall chinook salmon have the potential to spawn in the existing navigation channel, no spawning is anticipated based on lower water velocities in this area. In 1992, while dredging the channel to the juvenile fish facility (an area outside the defined navigation lock approach channel), a redd was destroyed (Figure 5 at arrow). However (where suitable substrate exists), the tailraces of the dams were surveyed each year from 1993 to 1996, and again in 2002. No redds were found in the Federal navigation channel or in the tailrace of the dam (Mueller 2003). The Corps plans to repeat the redd survey in 2003, just prior to the dredging activity, to ensure no redds will be disturbed. It is anticipated that dredging this area would have only minor impacts to fish populations or habitat.

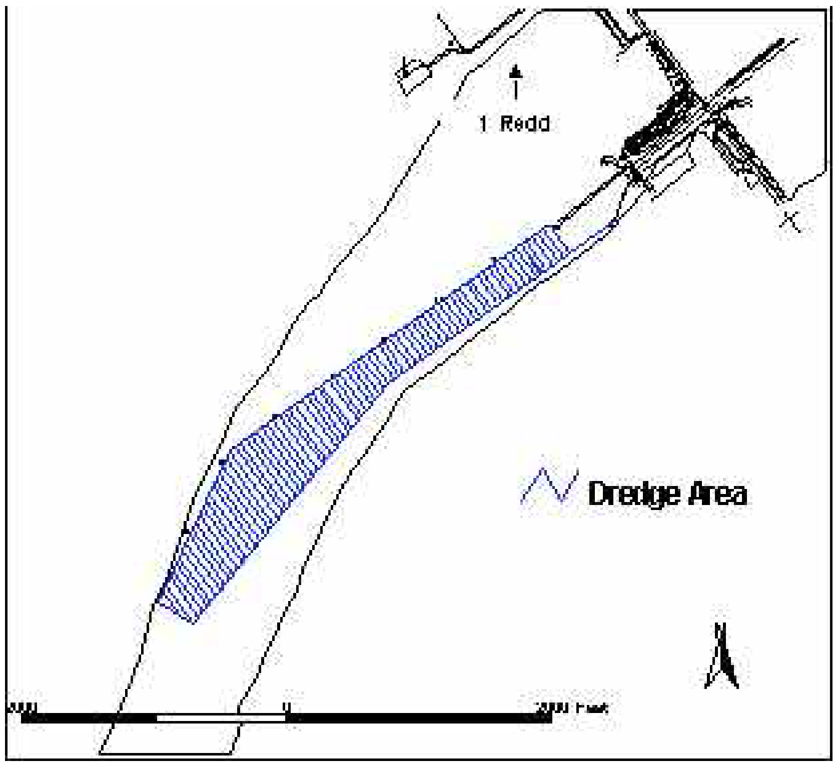


Figure 5. Lower Monumental Tailrace showing the dredging footprint in the cross hatching and the only known spawning location (1992) at the tip of the arrow.

2.4.8 Site 4a - Illia Boat Launch

The Corps anticipates dredging up to 1,400 cy (1,070.4 m^3) of material from the Illia Boat Launch (see Figure 6) in Winter 2003-2004. Dredging would be aimed at restoring the basin to a depth of no more than 8 feet (2.4 m) in the area designated on plate 8. Dredging has never occurred at this boat launch. Sediment surveys in June 1997 discovered that sediment composition was 86- to 95-percent silt and 5- to 14-percent sand. Dredging at this location is expected to remove 1.0 acre (0.4 hectare) of shallow-water silt habitat.

In 2002, Bennett found a notable number of juvenile salmonids at this location. Specifically, a total of 123 chinook, 14 sockeye, and 4 steelhead were collected, primarily in June of that year. However, because of the small size of the boat launch at Illia, the large amount of shallow waters adjacent to the boat launch and, given that dredging would occur during the winter in-water work period, it is anticipated that dredging this area would have only minor impacts to anadromous fish populations.

Figure 6. Illia Boat Launch, dredging area circled.

2.4.9 Site 4b - Willow Landing Boat Launch

The Corps anticipates dredging up to 6,200 cy (4,740.2 m^3)] of material from the Willow Landing Boat Launch in Winter 2003-2004. Dredging would be aimed at restoring the basin to a depth of no more than 8 feet (2.4 m) in the area designated on plate 9. Dredging has never occurred at this boat launch.

Sediment surveys in June 2000 discovered that sediment composition was 56 to 67 percent sand and 21 to 27 percent silt. Dredging at this location is expected to remove 1.4 acres (0.6 hectare) of shallow-water sand and silt habitat. Bennett *et al.* (1997) reported that juvenile fall chinook salmon in Lower Granite reservoir prefer sandy substrates. The location of this launch is such that it continually collects silt. Dredging this area is not expected to have either short- or long-term deleterious consequences to endangered fish habitat, because dredging would occur during the winter in-water work window.

In 2002, Bennett found a notable number of juvenile salmonids at this location. Specifically, a total of 246 chinook, 1 sockeye, and 2 steelhead were collected, primarily in June of that year. However, because of the small size of the boat launch at Willow and the large amount of shallow waters adjacent to the boat launch (Figure 7), it is anticipated that dredging this area would have only minor impacts to anadromous fish populations.

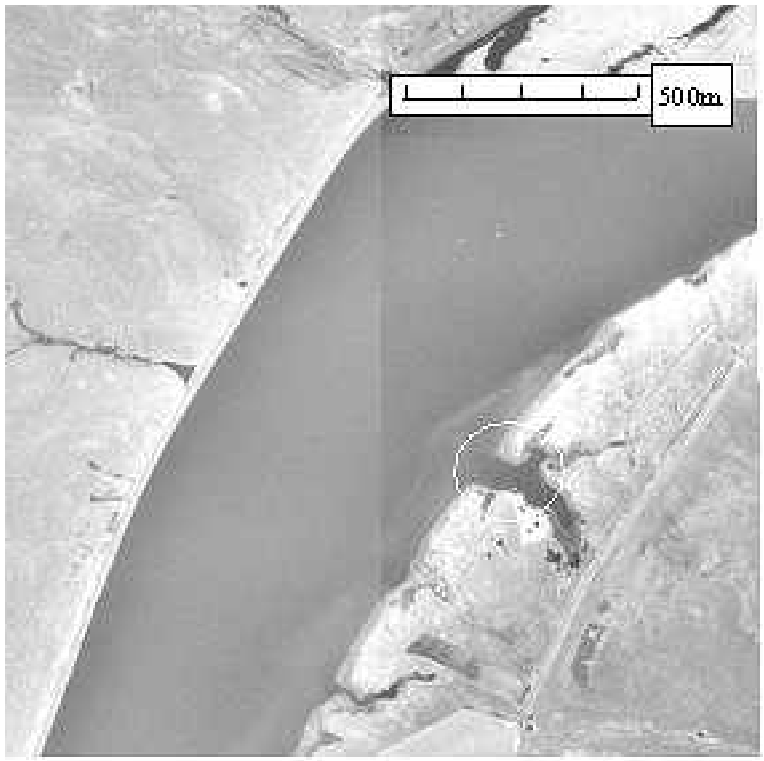


Figure 7. Willow Boat Launch, dredging area circled (note adjacent shallow-water habitat along the shoreline).

2.5 Dredging Methods and Timing

For the dredging proposed for the navigation channels, slips, and berths of the Snake and Clearwater rivers navigation system in 2003-2004, mechanical dredging would be used. Mechanical dredging methods could include clamshell, dragline, backhoe, or shovel/scoop. Based on previous dredging activities, however, the clamshell method would most likely be used for the larger quantities.

Clamshell dredges of approximately 15-cy (11.5-m^3) capacity and barges with a capacity of up to 3,000 cy (2,293.7 m^3) and with maximum drafts of 14 feet (4.3 m) would be used although smaller clamshell buckets may be used in some locations. The Corps estimates it could take about 6 to 8 hours to fill a barge. The expected rate of dredging is 3,000 to 5,000 cy (2,293.7 to 3,822.8 m^3) per 8-hour shift. Material would be scooped from the river bottom and loaded onto a bottom-dump barge for in-water disposal or a bin-type barge for upland disposal. While the barge was being loaded, the contractor would be allowed to overspill excess water from the barge, discharged a minimum of 2 feet (0.6 m) below the river surface.

The barge would then be pushed by a tug to the disposal site. No material or water would be discharged from the barge while in transit. If the disposal location were an in-water site, when the barge arrived and was properly positioned, the bottom would be opened to dump the material all at once. If the disposal location were an upland site, the barge would be pushed to a port facility and unloaded using mechanical equipment. Once unloaded, the barge would be returned to the dredging site for additional loads.

The contractor could be expected to work between 10 and 24 hours per day, 6 to 7 days per week. Dredging in the navigation channels, slips, and berths would be performed within the established in-water work window (currently December 15 through March 1 in the Snake and Clearwater Rivers). Multiple-shift dredging workdays would be used when necessary to ensure that dredging was completed within these windows.

2.6 Dredged Material Disposal

2.6.1 Beneficial Use – Creation of Shallow-Water and Woody Riparian Habitats

The Corps plans to use the dredged material for beneficial use. This use is consistent with Corps policy to secure the maximum practicable benefits through the use of material dredged from navigation channels. The Corps proposes to use in-water disposal for the majority of the dredged material to create (primarily) shallow and mid-depth fish habitat, and woody riparian planting benches. The in-water disposal site at RM 116 was selected because it is on the inside of a river bend, has suitable water velocities and underwater contours to facilitate habitat creation, and is configured so the dredged material can be deposited without burying known cultural resource sites.

Studies conducted on the lower Snake River from 1988 to 1993 indicated that substrate of sand, gravel, and/or cobble provided suitable habitat for juvenile salmon while silt substrate provided little benefit (Bennett *et al.*, 1997). In addition, research in 2002 indicated a high density of anadromous fish rearing in areas of primarily silt near Chief Timothy State Park (Bennett *et al.,* 2002, Unpublished data—report in progress). Juvenile fall chinook salmon prefer shallow, open sandy areas along shorelines for rearing (Bennett *et al.*, 1997). Bennett *et al*. (1997) showed that fall chinook salmon used the shallow-water habitat created with in-water disposal of dredged material that surrounds Centennial Island (in Lower Granite reservoir near RM 120). In some years, as many as 10 percent of the total sample of subyearling chinook salmon from the Lower Granite reservoir originated from the habitat created by in-water disposal. Bennett *et al.* (1997) reported that fall chinook salmon were most commonly collected over lower gradient shorelines that have low velocities and sandy substrate. Habitat having these physical characteristics can be effectively constructed in any of the lower Snake River reservoirs with the appropriate placement of dredged material.

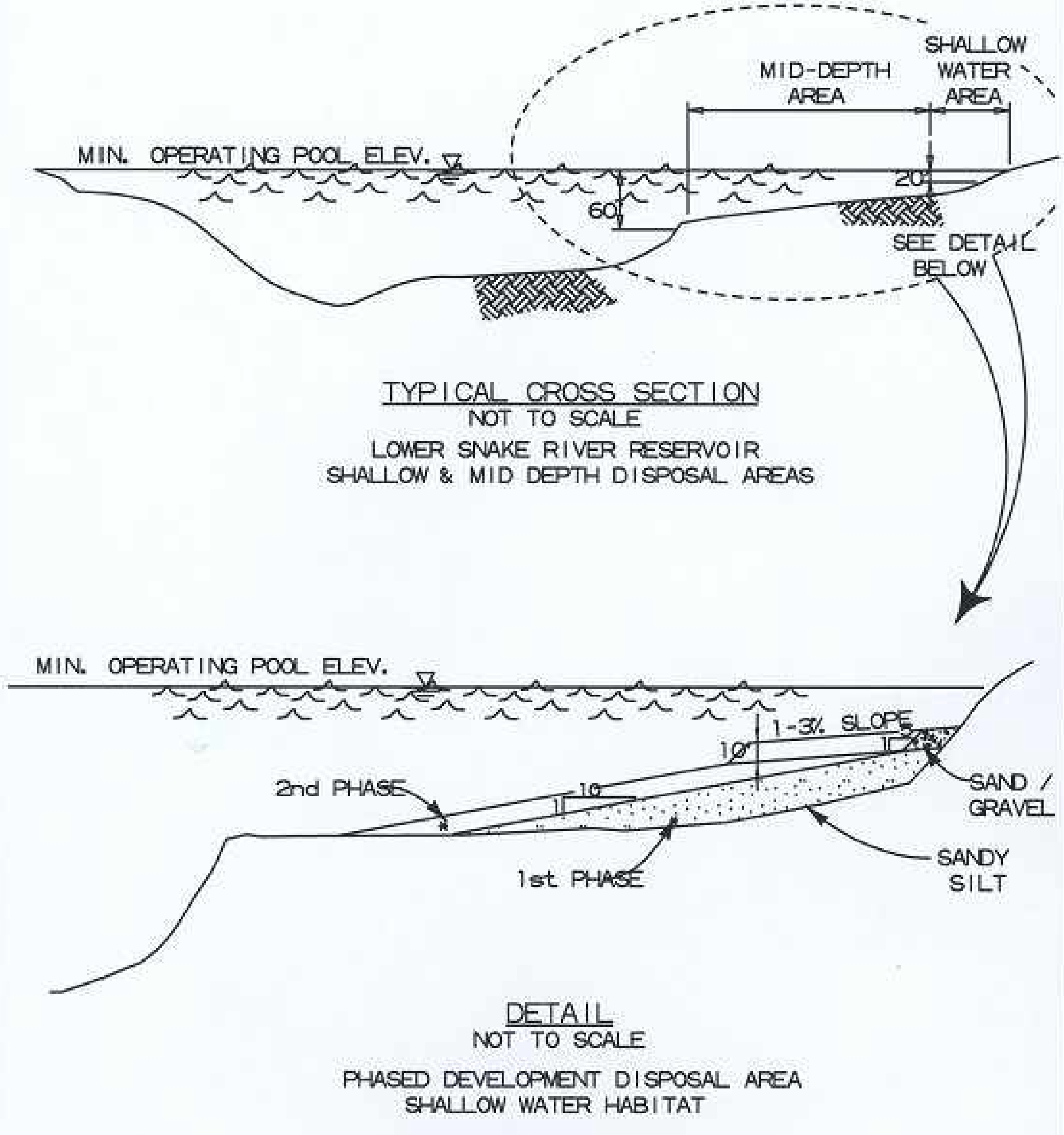
The disposal process is dependent on the physical characteristics of the dredged material, and the potential to optimize the benefit to fisheries. Dredged materials would be composed mostly of sediment containing a mixture of silts, sands, gravels, and cobbles. Sediment samples have been taken from the areas to be dredged in 2003-2004, and are currently being evaluated for particle size, contaminant levels, and suitability for in-water disposal. Particle-size analysis identified the dredging sites or portions of sites that contain mostly silt, as well as ones that contain mostly sand or coarser material. Based on previous experience, 85 percent of the material is expected to be sands [grains greater than 0.008 inch (0.2 millimeter (mm)) in diameter] and gravels and cobbles, while 15 percent of the material is expected to be silts and finer-grained material.

The standard practice employed by the Corps for contracting this type of work is to specify the environmental protection requirements and final design specifications that must be met by the contractor, but allow the contractor to determine the exact construction methods that would be used to meet the contract requirements. The contract for the proposed 2003-2004 dredging would focus on requirements (*i.e.*, turbidity level, work window, slope of underwater fill, placement of a silt cap for the riparian bench and a sand cap for the aquatic habitat) rather than placement methods, to allow the contractor to be as innovative as possible. Prior to any work being performed in the field, the contractor will be required to submit a work execution plan, including how they intend to meet environmental requirements. Until the contractor submits a plan, the exact placement method is undetermined, but the most likely placement scenarios have been included in the following sections:

2.6.1.1 Shallow-Water Habitat Creation

The sequence of dredged material disposal is designed to dispose of silt in a beneficial manner by creating shallow-water habitat for juvenile salmon and woody riparian habitat to benefit salmon and other species. To accomplish this, the dredged material would be placed in steps. The first step would be to use the dredged sediment [less than 0.0024 inch (0.062 mm) in diameter], in a mixture with sand and gravel/cobble, to fill the mid-depth portion of a site and form a base embankment (Figure 8). Prior to dredging, the sediment would be analyzed to determine the percentage of sand or silt in order to ensure that the mixture in the embankment was not more than 30-percent silt.

The dredged material would be transported to the disposal area, where the material would be placed within the designated footprint. This footprint would be close to the shoreline, so that the river bottom could be raised to create an underwater shelf about 10 feet (3.0 m) below the desired final grade. The second step is to place sand on top of the sand/silt embankment. An area of sand would be reserved as the final area to be dredged during the dredging activity.



SHALLOW MID-DEPTH DISPOSAL

Figure 8

Sand would be placed on top of the base embankment in sufficient quantity to ensure that a layer of sand at least 10 feet (3.0 m) thick covers the embankment once the final step of the process is completed (Figure 9). The footprint of the disposal area would be sized so that the maximum amount of shallow-water habitat is created with the estimated quantities of material to be removed during that dredging activity.

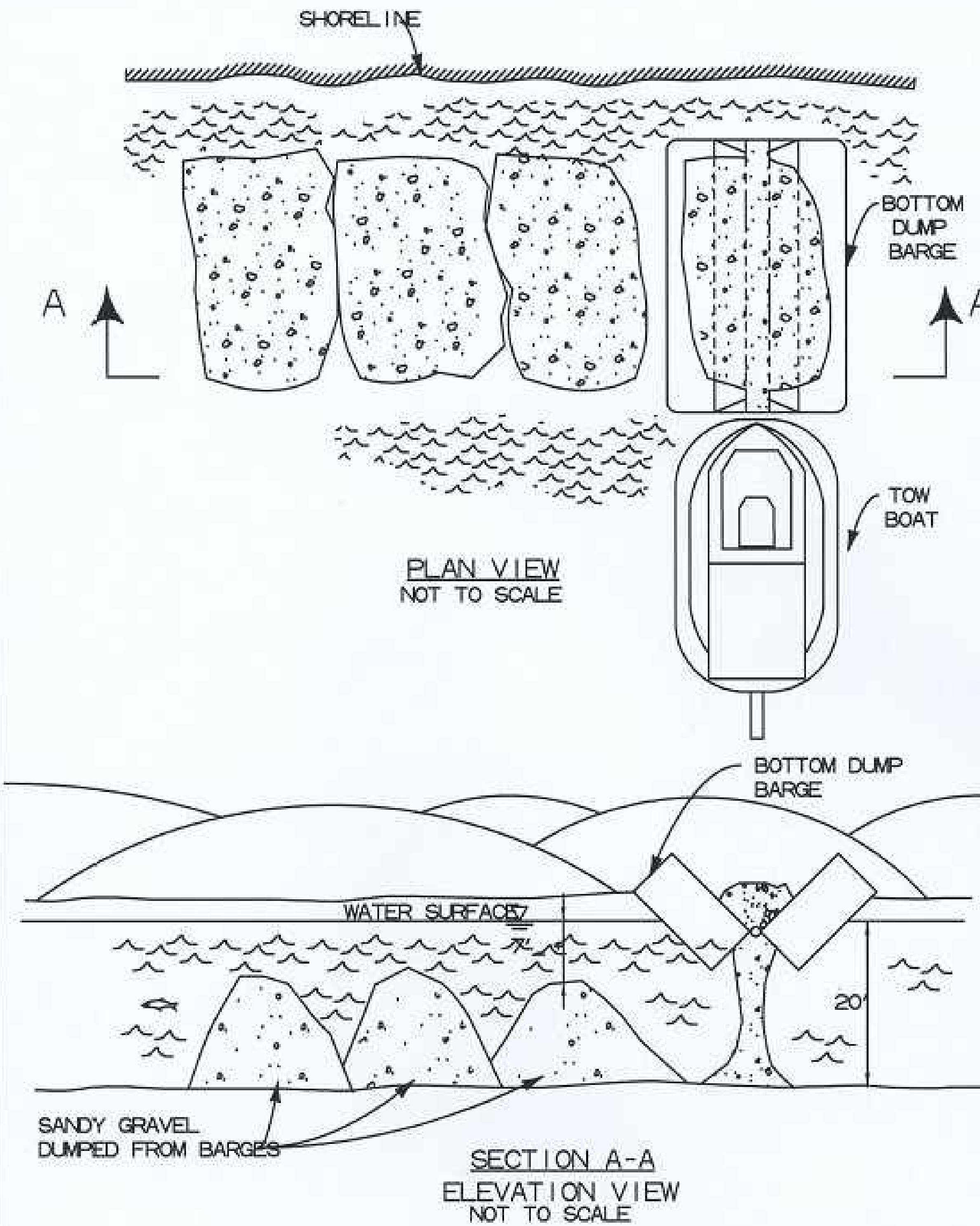
The final step involves flattening and leveling the tops of the mounds to form a smooth, gently-sloping (3 to 5 percent) shallow area with water depths up to 20 feet (6.1 m), as measured at MOP (Figure 10). The sand cap layer would be created with a minimum thickness of 10 feet (3.0 m) to ensure that the most desirable substrate (sand with limited fine-grained or silt material) is provided for salmonid-rearing habitat.

Monitoring embankment stability would be accomplished by taking cross-section soundings soon after disposal was complete and, again, in the summer after high flows to determine if the embankment slumped or moved. The Corps would use this information to make adjustments in the percentage of silt allowable for potential future dredged material disposal, and to determine whether or not a berm should be constructed around the toe of the embankment to prevent movement.

2.6.1.2 Creation of Woody Riparian Planting Bench

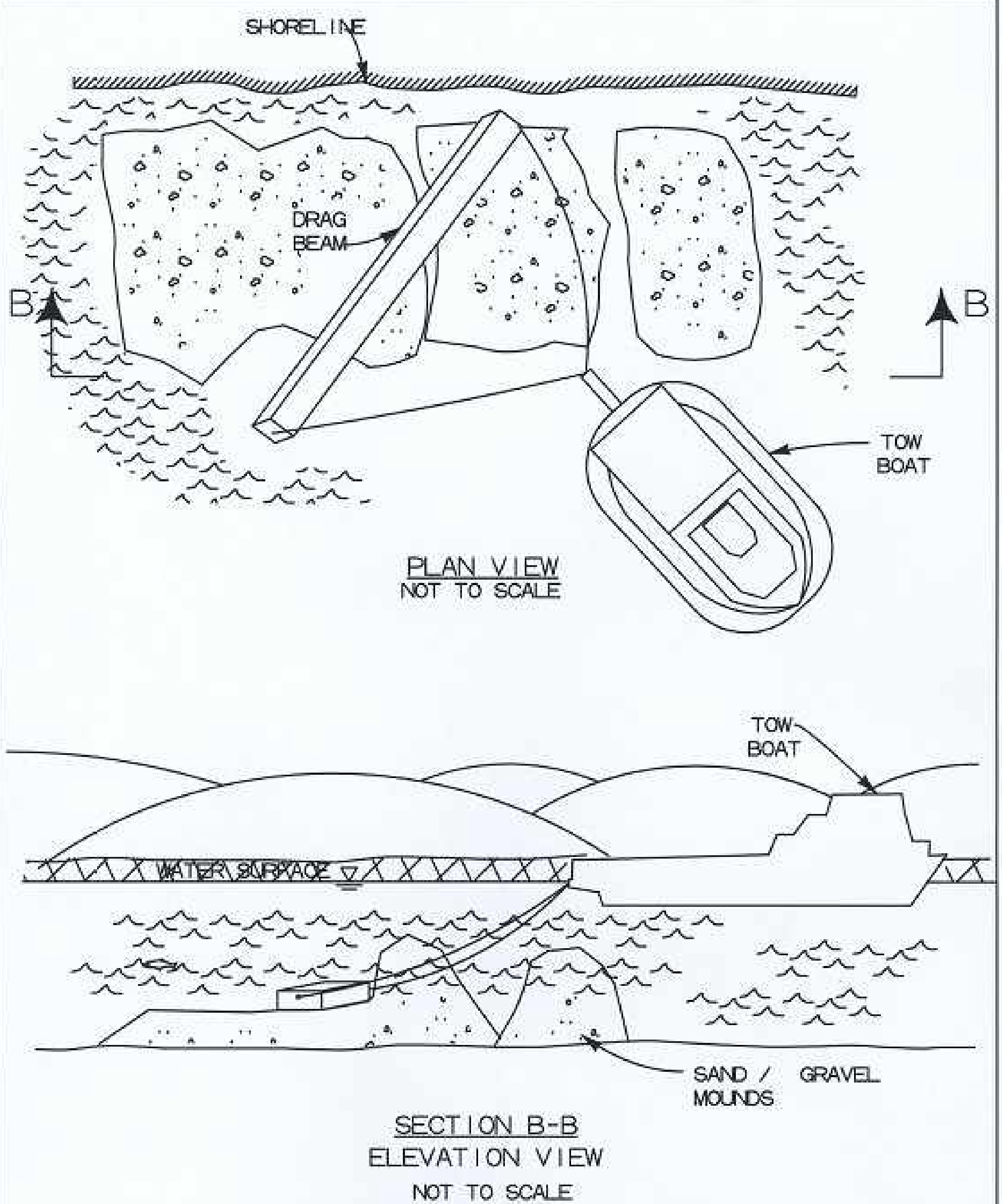
For the creation of the woody riparian planting bench, the Corps has identified four possible placement scenarios: 1) construction of earthen cells and hydraulic placement of material within the cell; 2) silt curtain cells used with hydraulic placement; 3) a combination of silt curtain and earth embankment with hydraulic placement; and 4) placement using a bottom dump with clamshell or dragline. Each of these methods is discussed in subsequent paragraphs. In addition to these scenarios, it may be advantageous to raise and/or lower the Lower Granite pool during placement operations within the designated in-water work window. For example, a deeper pool would allow barge access closer to shore. Lowering the pool may facilitate placement of the silt cap on the riparian bench.

- **Scenario 1 - Construction of earthen cells and hydraulic placement within the cells.** This method employs all of the placement methods mentioned above. First, an earth berm would be constructed along the outer edge of the disposal area. This would be accomplished by pushing dredged material off flat-deck barges or bottom-dump scows. Boats would be used to position the floating dragline, which would then be set up on the inside of the earth berm. Once the berm was constructed to a depth that precluded placement from a flat-deck barge or bottom-dump scow, the dumps would be made outside of the berm. The dragline would be used to scoop the dumped material and place it on top of the berm. This would be repeated until the berm was above the water surface. Cross berms would be constructed using the dragline perpendicular to shore, between the shore and the berm. This would



SHALLOW WATER DISPOSAL - BOTTOM DUMP PROCESS

Figure 9



SHALLOW WATER DISPOSAL - DRAG BEAM CONTOURING PROCESS

Figure 10

create containment cells. Once the containment cells were complete, all remaining dredged material would be placed hydraulically. Placement would begin at the upstream cell and work downstream. It is expected that the cells would contain any turbidity that might occur during placement. Materials used for berm construction would be mostly sand, with some gravels and cobbles intermixed. The fill inside the cells would be mostly sand to just above the water surface. The shoreline portion of each cell, which defines the riparian bench, would then be capped with hydraulically-placed silt from the recreation sites and ports.

- **Scenario 2 - Silt curtain cells used with hydraulic placement.** This would be similar to Scenario 1, except the containment cells would be formed using a geotextile fabric draped to the river bottom to act as a silt barrier. If necessary, the bottom edge would be anchored. Material would be hydraulically placed within the geotextile containment cell. Placement would proceed until material within the cell was at the existing water surface. The geotextile fabric would be moved downstream, and an adjacent cell would be similarly formed. This would continue for the length of the disposal area. Once the fill had been brought up to the water surface, the shoreline portion of each cell (which defined the riparian bench) would be capped with silt material from the dredging operations. A silt fence would be installed on the fill, and material would be placed hydraulically inside the silt fence.

- **Scenario 3 - Lower Granite pool would be raised to the maximum operating pool.** Placement would be performed from flat-deck barges or bottom-dump scows, as much as possible, in the depth provided. Once the placement reached an elevation where flat-deck barges or bottom-dump scows could no longer place their load, a silt curtain would be installed and a containment cell formed, as discussed above. Dredged material would be placed hydraulically within the silt curtain. Once the platform within that cell reached the water surface, the silt curtain would be relocated to form the next cell. Once the fill had been brought to the water surface, the shoreline portion of each cell (which defined the riparian bench) would be capped with silt material from the dredging operations. A silt fence would be installed on the fill, and silt would be placed hydraulically.

- **Scenario 4 - Placement using a dragline.** The Lower Granite pool would be raised to the maximum operating pool. A dragline would be moved as close to shore as possible. Flat-deck barge or bottom-dump scow placement would be performed, as much as possible, in the depth provided. As the bench is brought to the water surface, and depths are inadequate for dumping directly from the barge, the dumping would occur on the river side of the dragline. After each dump, the dragline would excavate that material and place it in the fill. This would continue until a section of the bench was complete within the reach of the dragline. The silt cap would be similarly placed once the riparian bench had been brought to the water surface. A silt containment structure, such as a silt fence or other barrier, may be needed to prevent suspended sediments from re-entering the river.

2.6.2 Final Shaping

Some underwater grading and final shaping would be required by the contractor once the bench and slope is completed. Shaping of the in-water slopes most likely would be accomplished by floating dragline. A boat-towed beam may also be used. Above-water surface shaping of the capped area would be by conventional grading equipment (*i.e.*, dozer, rubber tired loader, or backhoe), and would be performed sometime after placement of the dredged material was complete. Some surface undulations would be desired to provide differing root zone conditions for the riparian species planted.

Once the final shaping of the shoreline was complete, the gravel and cobbles excavated from the navigation lock approaches would be placed around the perimeter of the bench to form a protective zone from erosion. This would likely be performed using a clamshell and a flat-deck barge. The material would be brought by barge to the disposal site, and the clamshell would lift the gravel and cobbles off the barge and place them in a band within the selected elevations along the shoreline. The gravel and cobble zone would be "final shaped" to a relatively smooth surface into the sand mixture to mimic a naturally-formed, smooth, exposed sandbar.

2.6.3 Knoxway Canyon Disposal Site

For the 2003-2004 dredging, the disposal location selected is at RM 116 in the Lower Granite reservoir. This site is a 44-acre shallow bench on the left bank of the Snake River, just upstream of Knoxway Canyon. The Corps selected this site because it is close to the confluence (where most of the dredging would occur), could provide suitable resting/rearing habitat for juvenile salmon once the river bottom is raised, would not interfere with navigation, would not impact submerged cultural resources, and is of sufficient size to accommodate dredged material disposal for 2003-2004.

Cobbles, silt, and silt/sand mixture placement in 2003-2004 would occur in a manner that would extend the shore riverward along the proposed disposal site (RM 116). This would ultimately result in the creation of a planting bench for riparian species that would submerge within the water surface elevation range between 736 and 738 fmsl. The Lower Granite reservoir maximum operating pool is elevation 738 fmsl, and MOP is elevation 733 fmsl. The overall plan is to place the sands in the below-water portion extending riverward of the riparian embankment. Riverward to the riparian bench, sand would be placed to enhance the rearing suitability of the mid-depth habitat bench, by decreasing the depth at a 1 vertical to 10 horizontal slope across the newly created shallow-water rearing habitat.

The Corps recognizes that it may take several dredging operations over a period of years to complete construction of one shallow-water site. Therefore, once the Corps starts to create shallow-water habitat, it would become a high priority to use available dredged material at that site until the maximum amount of shallow-water habitat has been created. This assumption is based on dredging continuing as the means of addressing sediment input.

2.6.4 Knoxway Canyon Disposal Site - History

The following paragraph contains a historical description of the Knoxway Canyon disposal site, based on information dating back to 1917.

- In 1917 and 1934, based on maps of depth soundings…Knoxway Canyon came out of upland to meet the lower Snake River immediately downriver of Truax Rapid [2 to 7 feet (0.6 to 2.1 m) deep, water velocity of 7 miles per hour (mph) (11.3 kilometers per hour), as measured in October 1917] on slightly outside bend of river. A ferry crossing across the river and a road to Pomeroy, Washington, were present through Knoxway Canyon. The habitat quality was likely good for the spawning and rearing of anadromous salmonids.

- In 1958, an aerial photo shows that…the proposed disposal site was positioned on an upland section of the floodplain of the greater-than-100-year flood, behind a road (similar to the grass/forb-covered upland section of Wilma upriver near the Clearwater River confluence). The specific disposal site was in dryland orchard, with grasses and forb coverage; and was also used for livestock grazing. Riverward of the road lay a long, linear, sandy shoreline along the water's edge, connected to large sandbars downriver of the canyon mouth. The habitat quality was likely good for spawning and very good for rearing. Road access and the presence of orcharding introduced increased human disturbance, especially along the high quality sandbars.

- In 1974, an aerial photo indicates…vegetation and structures had been removed in preparation for reservoir fill. Habitat quality was likely poor for spawning at the foot of the rapid, but likely fair for rearing.

- In 1992, based on both an aerial photo and personal observation…during the experimental physical drawdown test of the Lower Granite reservoir…reservoir water covered the pre-dam shoreline and terrace up to the rock bluff face, and several tens of meters up the canyon, for the previous 18 years. The exposed underwater section of mid-depth bench was completely covered with silt and fine sand deposition due to low velocities, but heavier sand was deposited on the larger opposing bar on the sharper inside bend of the river. Habitat quality was likely nonexistent for spawning at the foot of the rapid, and likely lost for historic rearing. The road and the presence of orcharding that introduced increased human disturbance were gone, and new rearing habitat on the previous upland parcel of orchard was likely poor quality after 18 years of slow deposition of fine material.

- Current status…is a mid- to shallow-depth bench composed of silt accumulated on the left bank. Since visual inspection of this site in 1992 (during the experimental drawdown of the Lower Granite reservoir), habitat suitability has been poor for rearing and overwintering due to the thick silt layer accumulating at about 2 inches (5.1 cm) per year for 25 years [approximately 4 feet (1.2 m)], over a sand base (less than 20 percent composition). Habitat suitability for spawning is nonexistent.

2.6.5 Newly Created Habitat Sediment Testing

Monitoring of disposal activities will consist of sediment sampling by the dredging contractor at the disposal area to determine grain size composition of the materials and to verify the in-place conditions of the sediments. Sediment samples will be taken by the contractor, using vibracore drilling (see section 6.6 for further detail). For the underwater portion of the site, this sampling will occur anytime starting one day after the last deposit of dredged material, and will be completed prior to the end of the in-water work window (1 March 2004).

2.6.6 Upland Disposal

If dredged material is determined to be unsuitable for in-water disposal, depending on the level and type of contamination, it could be disposed of upland, either at a licensed disposal facility or at a suitable Corps site.

The preferred upland disposal area is the Joso site, a former rock quarry. Disposal of dredged material at this location would create more productive upland habitat than the existing barren and rocky landscape. Use of the site is also economically and technically viable.

Silt suitable for in-water disposal and found in excess of the maximum permitted during construction of the base layer for the habitat site (not to exceed 30 percent of the total base material) would be considered for other beneficial uses. One of these uses would include using the silt material to provide a planting layer for developing woody riparian habitat on top of the planting bench.

2.6.7 Sediment Contaminant Analysis

In addition to sampling particle size, the Corps had a series of analyses performed on samples collected in 2000 and again, in 2003, to determine chemical content of sediments at potential dredging sites in the lower Snake River and in the confluence of the Snake and Clearwater Rivers. In 2003, chemical tests included polynuclear aromatic hydrocarbons (PAHs); organophosphorus pesticides; acid herbicides; oil, grease, and total petroleum hydrocarbon (TPH); polycholorinated biphenyls (PCBs); ammonia; dioxin; and metal analyses.

The sediments at sixty-eight sites in the lower Snake River and a segment of the Clearwater River were evaluated during the latter part of April 2003. Samples from twenty-five of these sites were further processed for Tier IIB analyses based on total volatile solids (TVS) concentrations and particle size distribution.

The majority of the provisional results were either below instrument detection limits or less than established sediment criteria. The twenty-two metals that constitute the target analyte list (TAL) were at concentrations less than the Puget Sound Dredge Disposal Analysis (PSDDA) criteria and typically lower than state-wide averages. Approximately 200 organic herbicides, pesticides, and industrial compounds were considered. All of them, including dichlorodiphenyltrichloroethane (DDT), dioxin, and polychlorinated biphenyls (PCBs), were either not detected or present in quantities that are not considered harmful to the environment. The TPH-diesel concentrations were all ≤ 82 parts per million (ppm).

One compound, ammonia, does warrant further consideration because of the relatively high concentrations recently found in most of the lower Snake River fine sediments (silt). Over the last number of years, most of the potential dredging sites in the lower Snake River have been tested for the concentration of ammonia in sediment. Ammonium (NH_4^+-N), itself, is generally only toxic in large concentrations. It is the un-ionized portion of ammonia (NH_3-N) that is toxic to aquatic organisms. Un-ionized ammonia is more toxic because it is a neutral molecule and, thus, has the ability to diffuse across the epithelial membranes of aquatic organisms far more readily than a charged ion. High external un-ionized ammonia concentrations reduce or reverse diffusive gradient and cause the buildup of ammonia in gill tissue. Assuming that ammonia and un-ionized ammonia have different partial toxicity, the un-ionized ammonia is 100 times more toxic than ionized ammonia. Studies show that un-ionized ammonia toxicity has a measurable correlation to pH.

Ammonia is present in sediments in each of the four reservoirs of the lower Snake River. The concentration of ammonia in the sediments, when compared to the potential amount of dissolved ammonia, makes unconfined excavation of sediments in the summer undesirable because the amount of un-ionized ammonia increases as water temperature increases. Un-ionized ammonia also increases when pH levels exceed 7.5.

Waters of the Snake River have a high alkalinity, with a pH typically between 7.8 and 8.5, and typically low ammonia concentrations. Elutriation tests were conducted in 1997 to obtain estimates of ammonia dissolved in the water after in-water suspension of dredged material. These evaluations were completed at pH 8.5 and approximately 20 degrees Centigrade (^{o}C). As such, the *in situ* NH_3-N concentrations near dredging and disposal activities would probably be less than those determined by the elutriation tests—due to colder winter temperatures, dilution, sediment composition, ambient pH, and the rapid conversion of NH_3-N to NH_4^+-N. Although ambient ammonia levels resulting from winter dredging and disposal activities are unknown at this time, the Corps does not anticipate that water quality standards will be exceeded outside the boundaries of a mixing zone, as approved by the Washington Department of Ecology. To ensure water quality standards are not exceeded, the Corps will monitor ammonia levels in the vicinity of dredging and disposal activities and modify the operation if limiting values are reached. Table 3 compares elutriation data to average concentrations of sediment ammonia for each reservoir, to mean reservoir pH, and to the National Criterion for Ammonia in Fresh Water (EPA, 1999).

Table 3. Elutriate Ammonia Concentrations and Related Water Quality/Fish Criteria

	Lower Granite	Little Goose	Lower Monumental	Ice Harbor
Elutriate Ammonia Average in milligrams per liter (mg/L)	3.6 mg/L	2.6 mg/L	2.5 mg/L	3.6 mg/L
Dissolved Elutriate Percentage	4.7%	4.0%	4.2%	4.4%
Average Forebay Concentration of Ammonia in mg/kg	75.7 mg/kg	64.3 mg/kg	59.6 mg/kg	81.3 mg/kg
Anticipated Maximum pH in Winter (data source)	8.4 pH (1)	8.3 pH (1)	8.3 pH (1)	8.3 pH (1)
Early Life Stage Chronic Criterion	1.29 mg/L	1.52 mg/L	1.52 mg/L	1.52 mg/L
Acute Criterion with Salmon Present	2.59 mg/L	3.15 mg/L	3.15 mg/L	3.15 mg/L
Acute Criterion with Salmon Absent	3.20 mg/L	4.71 mg/L	4.71 mg/L	4.71 mg/L

(1) Estimated pH from previous monitoring.
(2) EPA, 1999.
(3) WADOE 2003.

Potential impacts due to ammonia releases vary for each reservoir. The average elutriate ammonia concentration from Lower Granite reservoir sediment samples was 3.6 mg/L (Table 3). This result was 1.4 times higher than EPA's acute criterion for salmon (EPA, 1999) and the State of Washington water-quality acute substances criteria (WAC 173-201A) calculated for the anticipated winter-time water temperatures and pHs. The elutriate dissolved ammonia concentration was also 2.8 times higher than EPA's early life-stage chronic criteria. Potential impacts to water quality and/or fish in Ice Harbor reservoir would approximate those in the Lower Granite pool due to the similar elutriate ammonia concentrations and ambient pH. The elutriate concentrations determined for the Little Goose and Lower Monumental pools were about 1 mg/L less than in the adjacent upstream and downstream reservoirs. Due to the dynamic nature of ammonia speciation and the uncertainty regarding *in situ* conditions during dredging and disposal, ambient monitoring should occur concurrent with any dredging operations to quantify possible impacts to water quality and/or fish.

A final, more comprehensive, report will be available in August 2003. This document will include the verified data sets, a comparison of 2003 information to that previously collected, and quality assurance/quality control documentation.

2.7 Emergency Dredging

The Corps may need to perform dredging on an emergency basis. An emergency, as defined in 33 Code of Federal Regulations (CFR) 335.7, is a situation that would result in an unacceptable hazard to life or navigation, a significant loss of property, or an immediate and unforeseen significant economic hardship if corrective action is not taken within a time period less than the normal time needed under standard procedures.

There are several potential situations that could occur in the Snake River that may require emergency dredging. High flows could deposit enough sediment at a point or points in the Federal navigation channel to block navigation. Rock could be swept into the navigation lock approach and form a shoal, or sediment could build up on the inside bend of the navigation channel, posing an unacceptable navigation hazard.

For an emergency dredging situation, the Corps would perform environmental coordination on an expedited basis. The Corps would perform as much coordination as possible before initiating the emergency dredging, but some coordination may be performed during the dredging or after the dredging is completed.

Under an emergency dredging situation, only the immediate area would be dredged; therefore, the quantities of material to be removed would likely be small. If the emergency dredging were to occur in the summer, the material would be disposed of upland. If the emergency dredging occurred in winter, the material could be disposed of either in-water or upland. Should the material be sand, it may be disposed of in-water at an existing in-water disposal site to aid in the creation of shallow-water habitat. If the material is silt, it could be used for beneficial purposes upland or disposed of upland in an appropriate facility.

3.0 PROJECT IMPACTS ON ESA-LISTED ANADROMOUS SPECIES

The following anadromous species are listed as either endangered or threatened under the ESA, and may be impacted by the winter 2003-2004 dredging.

- <u>Endangered:</u>

  Snake River Sockeye Salmon (*Oncorhynchus nerka*)

- <u>Threatened:</u>

  Snake River Fall-Run Chinook Salmon (*Oncorhynchus tshawytscha*)
  Snake River Spring/Summer-Run Chinook Salmon (*Oncorhynchus tshawytscha*)
  Snake River Basin Steelhead (*Oncorhynchus mykiss*)

3.0.1 Critical Habitat Considerations

The project areas are designated as Critical Habitat for all three Snake River salmon Evolutionarily Significant Unit (ESU) stocks. In designating critical habitat, NMFS considers the following requirements of the species: 1) space for individual and population growth, and for normal behavior; 2) food, water, air, light, minerals, or other nutritional or physiological requirements; 3) cover or shelter; 4) sites for breeding, reproduction, or rearing of offspring; and, generally, 5) habitats that are protected from disturbance or are representative of historical geographical and ecological distributions of the species.

In addition to these factors, NMFS also focuses on the known physical and biological features (primary constituent elements) within the designated area that are essential to the conservation of the species, and that may require special management considerations or protection [termed Essential Fish Habitat (EFH) pursuant to the Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. 1801 *et seq.*]. These essential features may include, but are not limited to, spawning sites, food resources, water quality and quantity, and riparian vegetation [50 CFR 424.12(b)]; and can generally be described to include the following: juvenile rearing areas; juvenile migration corridors; areas for growth and development to adulthood; adult migration corridors; and spawning areas. Within these areas, essential features of critical habitat include adequate substrate, water quality, water quantity, water temperature, water velocity, cover/shelter, food, riparian vegetation, space, and safe passage conditions. Adjacent riparian area is defined by NMFS as the area adjacent to a stream (river) that provides the following functions [components of Properly Functioning Habitat (PFH) or Properly Functioning Condition (PFC)]: shade, sediment transport, nutrient or chemical regulation, stream bank stability, and input of large woody debris or organic matter.

Section 9 of the ESA makes it illegal to “take” a threatened or endangered species of fish. The definition of “take” is to “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct” [16 U.S.C. 1532(19)]. The NMFS interprets the term “harm” in the context of habitat destruction through modification or degradation as an act that actually kills or injures fish.

Based on new information, the Corps believes that the potential for direct take, as well as modification to critical habitat for listed anadromous fish, exists. Concerns for steelhead include take on adults that may be migrating in the early winter, kelts that may be moving through the confluence area in early spring, or pre-smolts that may be overwintering. In addition, a small population of juvenile fall chinook salmon that have not outmigrated as subyearlings and spring/summer chinook may also be overwintering in the vicinity of the proposed dredging and disposal areas as indicated by passive integrated transponder (PIT)-tag data back to 1995, spring seining data back to 1991 (Bennett *et al.* 1999), and surveys in backwaters of the McNary reservoir (Easterbrooks, 1995, 1996, 1997, 1998).

There are also concerns addressing the potential direct take to fall chinook redds by removal of cobble from the two navigation lock approaches. Although this take is unlikely (while cobble substrates are present, flow, depth and slope conditions are not ideal for spawning), it could be minimized by performing pre-project spawning surveys in the tailwaters of the lower Snake River dams (Dauble *et al.*, 1998; Mueller, 2003). The effects of sediment remobilization on water quality would be monitored while dredging. Methods and technologies designed to detect and avoid, or minimize, negative effects that the Corps has not considered would be welcomed as recommended criteria from NMFS, through formal consultation.

Visual surveys of 1934 sounding data were used to recreate the pre-dam lower Snake River channel for the Lower Snake River Juvenile Salmon Migration Feasibility Study. (Fluvial Geomorphology Appendix H and Snake River Maps Appendix S, USACE 1999). This analysis demonstrated that an unimpounded large class river is primarily composed of greater than 70-percent shallow-water habitat in the form of opposing deposition bars of sand for most flow years, and at least 50- to 60-percent shallow-water habitat for very high flow years. In general, it is possible that historically, only 10 percent of the lower Snake River could have constituted deep water.

When the Lower Granite reservoir was filled in 1975, the historical shallow-water habitat was inundated. This converted approximately 40 to 60 percent of the shallow-water sand bar habitat used by juvenile fall chinook salmon into either mid-depth bench habitat, more suitable for white sturgeon (with minimal structural cover) or adults of resident predator species (with structure in the substrate), or deep-water habitat used by few species (see Table 4). An analysis of limiting conditions for reservoir-wide habitat readily indicates that low gradient, open sand, shallow-water habitat (with no additional cover structure) suitable for fall chinook salmon rearing habitat, should be the objective target for maximizing beneficial use of in-water disposal of dredged material.

Apart from this comparison between the abundance and suitability of historical versus existing shallow-water sandbar habitat, very few of the EFH components that existed along the shoreline of the lower Snake River reservoirs have been modified or eliminated in the recent past due to maintenance dredging. On the other hand, other associated human activities and economic growth along the shorelines have resulted in some modification of habitat that introduced additional needs for dredging. The two EFH components that may have been influenced by confluence dredging in the past are the juvenile migration corridor and the adult migration corridor. Specifically, the essential features of substrate, water quality, food (as in macroinvertebrate production), and safe passage conditions were affected. Adjacent to the footprint boundary for dredging in the confluence is a critically-important juvenile rearing area for fall chinook salmon along the shoreline at the port of Wilma (Snake RM 134).

Table 4. Absolute and Relative Quantification of Three Water Depth Habitats in Lower Granite Reservoir, Snake River (SR) and Clearwater River (CR) During the Early to Mid-1980's.

Pool Reach (RM)	Shallow (<20 ft) Acres (Percent)	Mid-Depth (20-60 ft) Acres (Percent)	Deep (>60 ft) Acres (Percent)	Total Acres (Percent of Total Pool or Reach)
SR107.4 – SR120.46	281 (8%)	1,241 (34%)	2,147 (57%)	3,669 (43%)
SR120.46 - SR146.33	983 (8%)	2,795 (58%)	1,017 (21%)	4,795 (57%)
SR107.4 – SR146.33	1,264 (15%)	4,036 (48%)	3,164 (37%)	8,464 (94%)
CR0.0 - CR4.4	349 (71%)	141 (29%)	0 (0%)	489 (6%)
SR107.4 - SR146.33 and CR0.0 - CR4.4	1,612 (18%)	4,177 (47%)	3,164 (35%)	8,953 (100%)

Notes:
(1) Estimates calculated from U.S. Army Corps of Engineers cross section profiles.
(2) SR120.46 is the mid-reservoir section where the majority of the fine silt and sand material settles out due to increased rate of depth affecting the slowing rate of water velocity.

The existing open, sandy, shallow-water rearing habitat within Wilma remains protected from modification of any bathymetric feature, and would not be affected by the proposed dredging in the mainstem channel. Dredging activities would be confined to the in-water work window, when very few salmonids would be either migrating or rearing pre-migration, so exposure to short-term increases in turbidity should be minimal. Dredging would not be allowed at elevations below the existing channel bottom contours, because removal of input sand and silt is the target. Therefore, native substrate classes of cobble and gravel suitable for spawning should not be affected. It has been routinely shown that macroinvertebrates displaced by dredged material removal aid in colonizing or supplementing existing populations at the in-water disposal sites. Populations at the removal site also become re-colonized relatively rapidly, depending on the season. Both locations are also influenced through the mechanism of drift (Bennett *et al.*, 1990, 1991, 1993a, 1993b, 1995a, 1995b; Bennett and Nightingale, 1996).

The EFH components that may be influenced by dredging in the boat basins and/or their approaches from the main channel are juvenile rearing areas, juvenile migration corridors, and adult migration corridors. Specifically-affected essential features would be substrate, water quality, water velocity, food (as in macroinvertebrate production), and safe passage conditions. Boat basins fill with fine substrate dominated by silt that is less suitable substrate for salmonids. In addition, high use by recreational boat traffic can limit a basin’s suitability for salmonid rearing. Dredging activities would be confined to the in-water work window when very few salmonids would be migrating or rearing, so exposure to short-term increases in turbidity should be minimal. Removal of unsuitable size classes of substrate should not have a negative effect. These areas would be dredged by mechanical means to drastically reduce the possibility of entrainment of any juvenile salmonid that may be present. Water velocities would not be affected, since these areas are functionally shallow-water back eddies more suitable for resident fish. Macroinvertebrates displaced by dredged material removal can aid in colonizing or supplementing existing populations at the in-water disposal sites, and populations at the removal site become recolonized relatively rapid depending upon season. Substrate quality in boat basins that have not been dredged in a number of years adds an additional concern, with the potential for the accumulation of bound contaminants in the silt as a result of both spillage from recreational watercraft fueling and activities and the downstream migration pollutants that tend to settle in the backwater eddy environment. Recent sampling in these basins indicates that concentrations of contaminant indicators are below the level that would preclude their disposal in water. In the event that a previously undetected pocket of visually-contaminated sediment was hauled up in the clamshell or bucket, the Corps would direct that such an area be investigated and, if appropriate, classified as Hazardous Waste, and would remove that material and deliver it to an appropriate and established waste disposal site as necessary.

Dredging in the lock approaches of lower Snake River dams may potentially influence some of the EFH components. Specifically, the essential features of substrate, cover/shelter and, possibly, food (as in macroinvertebrate production) may be affected.

Based on Geographic Information System (GIS) analysis, the total navigation lock area downstream from Lower Monumental and Lower Granite Dams compose roughly 26 and 28 percent of the entire tailrace surface areas, respectively. The actual percentage of the tailrace areas to be dredged in 2003-2004, however, is approximately 3.4 and 1.2 percent of the total tailrace areas. While dredging would remove the accumulated cobbles in the navigation lock, the maximum depth of cobble to be removed is roughly 3 to 4 feet of elevation, with the majority of the areas requiring much less removal. After dredging, the substrate left would remain cobble.

Prior to dredging, these areas would be surveyed for redds according to established protocol (Dauble *et al.*, 1995) as was done in 2002 (Mueller, 2003). If redds were found and verified, the location and duration of dredging would be modified to avoid the area. Although there is some potential for spawning in the navigation lock approaches, studies have indicated that there are only a few areas within the proposed dredging templates that could be classified as potential spawning areas, based on substrate, velocity, depth, and slope (Dauble *et al.*, 1998). Additional discussion of the suitability of these areas for spawning habitat is located in Section 3.2.1.2, below. In addition, it is probably not desirable for fish to be spawning at these locations, as regular shipping traffic would be expected to disturb any redds deposited there.

Because the area is used as a migratory corridor for the listed anadromous species, there is potential to modify that essential fish habitat. However, because the proposed dredging would not remove great depths of material, not greatly changing the cross-sectional areas of the tailrace areas; velocities are not expected to change in that area to a great degree, and would not degrade the migratory habitat.

The Corps believes that this proposed maintenance dredging, which would be contained entirely within the previously disturbed footprint (last disturbed in 1998), would not degrade the suitability of that habitat for Snake River spring/summer-run and/or fall-run chinook salmon, and/or Snake River steelhead, thus not adversely modifying critical habitat or EFH components in that area. This determination is made because the area is used primarily as a migration corridor for all life stages of these stocks.

Migration of each life stage of each stock is typically over by the in-water work window, with two exceptions: 1) The potential for utilization of the submerged shallow water for rearing and feeding by juvenile chinook and steelhead; and 2) some adult migration by B-run steelhead and kelts. None of the known or potential areas used by fall chinook for rearing would be disturbed by any dredged material removal action.

3.0.2 Direct Effects of Actions Common to ESA-Listed Anadromous Species

All dredging would likely be completed mechanically, using a clamshell. Due to the characteristics of this equipment, it is generally accepted that clamshell buckets are not likely to entrain fish. Specifically, the clamshell bucket descends to the substrate in an open position. The force generated by the descent of the bucket drives the jaws into the substrate. The jaws grab the sediment upon retrieval. During the descent, the bucket cannot trap or contain a mobile organism, because it is entirely open. Based on the operation of the clamshell dredge bucket, it has been determined that the dredging operation would not entrain salmonid species. The time of year would also substantially limit the possibility of impacting endangered salmon and steelhead.

Dredging and disposal activities are temporary, and would cause short-term and localized impacts by increasing turbidity and suspended solids. Although dredging operations may create a detectable plume extending 1,000 feet (304.8 m) downstream, operations causing a 5-nephalometric turbidity unit (NTU) increase over background (10-percent increase when background is over 50 NTU's) at a point 300 feet (91.4 m) downstream, would not be allowed. Based on the disparity between the turbidity increases anticipated as part of the dredging and disposal operation and the levels reported to be harmful to fish, it is determined that the dredging and disposal operations would not effect salmon and steelhead as a result of increased turbidity.

Dredging and disposal would not cause impacts to water temperature or dissolved oxygen, because most activity would take place in cold weather during the in-water work window.

Vibracore drilling for testing the sediment composition of the newly created habitat would be conducted in the in-water work window soon after dredging. This drilling would cause short-term and localized impacts by increasing turbidity and suspended solids, as well as other disturbance potential. However, based on the work being performed during the in-water work window and the habitat not yet having been established with invertebrate species, little to no impact would be expected to anadromous salmonids due to this short-lived sampling effort.

3.1 Endangered Species

3.1.1 Snake River Sockeye Salmon (*Oncorhynchus nerka*)

3.1.1.1 Habitat Requirements/Population Status

Snake River sockeye salmon were listed as endangered in November 1991. These fish are unique in that they are the only species of Pacific salmon that depends on higher elevation tributary lakes in the Salmon River sub-basin of Idaho for spawning and rearing (Gustafson *et al*., 1997).

The lower Snake River corridor is designated as critical habitat for migration passage of wild Snake River sockeye salmon. Critical habitat attributes and EFH components for potential rearing or overwintering for Snake River sockeye salmon are not present in the lower Snake River corridor, or any of the proposed project areas. The components of the migration corridor and run timing of designated critical habitat and EFH for juvenile and adult migration passage are present between mid-March and mid-June. No spawning habitat for sockeye salmon is present in the proposed project area. Therefore, no individuals should use the dredging activity areas of the Snake or Clearwater Rivers for rearing, feeding, or overwintering during the designated in-water work period.

3.1.1.2 Known Occurrences in Project Vicinity

No adult or juvenile wild Snake River sockeye salmon should be present in the main stem Snake or Clearwater Rivers between mid-December and February. Wild Snake River juvenile sockeye salmon generally migrate downriver during April and May, and wild adult sockeye salmon are not typically counted at Ice Harbor Dam before June or after October (Corps Annual Fish Passage Reports, 1980-2000). In 2002 sampling, during May and June, Bennett *et al*. (2003) found 21 and 14 juvenile sockeye salmon apparently rearing along shallow-water shorelines in Lower Granite and Little Goose Reservoirs, respectively.

3.1.1.3 Effects of the Action

The proposed 2003-2004 dredging activities should have no discernable effect on the Snake River sockeye salmon stock. This is due to the typical absence of this stock in the Snake or Clearwater Rivers during the winter in-water work window. There should be little to no effect on individuals of the sockeye salmon stock through alterations of critical habitat caused by dredging, because this stock uses the proposed dredging areas primarily as migration corridors. However, because Bennett captured sockeye along shallow-water shorelines in 2002, this suggests that building shallow-water rearing areas could be beneficial to this species as well.

3.1.1.4 Conservation Measures

Because sockeye salmon are not likely to be found in the vicinity of the dredging and disposal operation during the proposed work, the type of dredging to be used (*i.e.*, primarily mechanical/clamshell), the tendency for fish to move away from disturbances, and the general lack of effect anticipated as a result of turbidity increases, no conservation measures are proposed.

3.1.1.5 Determination of Effect

Dredging and disposal operations proposed for the 2003-2004 dredging period would be done when sockeye salmon would not likely be present. In addition, there should be no discernable effect on individuals of these stocks through alterations of critical habitat caused by dredging because, although these stocks have been shown to use the shallow-water areas during the juvenile outmigration, they use the primary proposed dredging areas mainly as migration corridors. Thus, it is determined that the proposed 2003-2004 dredging and disposal operations "*may affect but are not likely to adversely affect*" sockeye salmon (see Table 5).

Table 5. Effects on Snake River Sockeye Salmon by Life History Stage and by Dredged Material Removal Location for 2003-2004 Proposed Dredging Operation.

Site Number *	***O. nerka*** egg to smolt	***O. nerka*** smolt	***O. nerka*** adult passage	***O. nerka*** adult spawning
1	OW NoE R NoE	NAA	NAA	NoE
2a	OW NoE R NoE	NAA	NAA	NoE
2b	OW NoE R NoE	NAA	NAA	NoE
3a	OW NoE R NoE	NAA	NAA	NoE
3b	OW NoE R NoE	NAA	NAA	NoE
3c	OW NoE R NoE	NAA	NAA	NoE
3d	OW NoE R NoE	NAA	NAA	NoE
4a	OW NoE R NoE	NAA	NAA	NoE
4b	OW NoE R NoE	NAA	NAA	NoE

Notes:
O. nerka = Snake River sockeye salmon   * See the site listing in table 2.
OW = overwintering
R = rearing
NAA = Not Likely to Adversely Affect
AA = Likely to Adversely Affect
NoE = No Effect

3.2. Threatened Species

3.2.1 Snake River Fall-Run Chinook Salmon (*Oncorhynchus tshawytscha*)

3.2.1.1 Habitat Requirements/Population Status

The lower Snake River corridor is designated critical habitat for migration passage of wild Snake River fall-run chinook salmon, which were listed as threatened in April 1992. Critical habitat attributes and EFH components suitable for potential rearing, overwintering, and migration passage for Snake River fall-run chinook salmon are present in the proposed project area. Very restricted spawning habitat for wild Snake River fall-run chinook salmon is present in the proposed project area, specifically, immediately downstream of each of the Lower Snake River mainstem dams.

Juvenile Snake River fall-run chinook salmon use shallow, open water, sand substrate in backwater-type and opposing bar habitat areas for rearing periods during their outmigration. These fish tend to outmigrate as subyearlings during their year of emergence, over a period of weeks or months, feeding and growing as they progress downriver (Bennett et al., 1997).

This ESU is comprised of a stock with a mainstem spawning lifestyle; and a few individuals could use the dredging activity areas of the Snake or Clearwater Rivers for rearing, feeding, or overwintering during the winter of the designated in-water work period.

3.2.1.2 Known Occurrences in Project Vicinity

Wild juvenile fall chinook salmon typically pass the project area from mid-June through September, with double peaks in mid-July and some lingering portion of the annual migration population lasting until December. Many of the juvenile fall chinook salmon outmigrating from the Clearwater and Snake Rivers spend time in shoreline areas [less than 9.8 feet (3 m) in depth] in Lower Granite reservoir and less time in downriver reservoirs, where they prefer sand-substrate areas (Curet, 1994; Bennett *et al.*, 1997). When water temperatures reach about 70 °F (21.1 °C), these fish appear to have achieved adequate growth and fitness, due to the warming conditions of these shallow-water habitat areas, and leave the shoreline areas to either continue rearing and/or begin their migration in the cooler pelagic zone of the reservoirs (Bennett *et al.*, 1997).

The PIT-tag detections of 1993 to 1995 brood year juvenile fall chinook salmon from the Clearwater River were recorded in the spring of 1994 to 1996 at some lower Snake River dams (Kenney, 1996). It is unknown whether these fish overwintered in the free-flowing Clearwater River or in one or more of the lower Snake River reservoirs. More PIT-tagged fall chinook outmigrants were detected in the spring of 1994 and 1995 than in the previous summer/fall, while the trend was reversed with the 1995 brood year. It is apparent from these detections that some Clearwater River fall chinook salmon migrate to the ocean as yearlings, rather than as subyearlings. Cold-water releases from

Dworshak Dam, aimed at augmenting flows for adult immigration, may cause stunted growth rates in juveniles in the late summer and early fall, causing these fish to overwinter. The Corps is unaware of information on the extent of overwintering of juvenile fall chinook in the Clearwater River, but has no reason to believe that overwintering in the area of the proposed dredging is a common behavior or occurrence. Overwintering and early rearing of fall chinook in the McNary reservoir backwater areas has been documented, and it would be logical to assume that the potential exists in the lower Snake River as well.

Adult wild fall-run chinook salmon migrate through the Snake River from late summer to early winter with spawning activity beginning in mid-October (Connor *et al.*, 1994). The low velocity and relatively fine substrate input to the upper reaches of the Lower Granite reservoir preclude spawning in the confluence area. Little spawning habitat is present in the proposed dredging areas overall, with the exception of the potential for limited fall chinook spawning in the tailrace areas of the lower Snake River dams (Dauble *et al.*, 1998).

Fall chinook salmon spawning has been known to occur in Little Goose (see Figure 3) and Ice Harbor reservoirs (see Figure 5), but only in tailwater areas directly downstream of the dams' bypass outfalls, where water velocity is high and substrate size is relatively large (Dauble *et al.*, 1995 and 1996). Proposed dredging in the designated navigation channels, in the tailwaters of the lower Snake River dams, has a low probability of excavating redds. A few redds had previously been located at various locations, using a GIS-directed field monitoring evaluation conducted between 1994 and 1998. No redds have been located in the tailrace areas downriver of the navigation lock approaches at Lower Granite or Lower Monumental since 1994; but redds have been found downstream of Little Goose and Ice Harbor Dams as recently as 1997 and 1996, respectively, although not in areas proposed for dredging (Dauble *et al.*, 1995, 1996, and 1998). Surveys conducted in the tailrace of Lower Granite and Lower Monumental Dams in December 2002 revealed no redds in the navigation channels or in areas where redds were found in the past.

In addition, the vast majority of usable spawning habitat in the tailrace areas of Lower Granite and Lower Monumental Dams, as determined by depth, velocity, substrate and slope (Dauble *et al.*, 1998) is not within the areas proposed for dredging (see Figures 11 and 12). Composite overlays of dredging locations and spawning locations can be seen on Plates 10 and 11.

No adult Snake River fall-run chinook salmon stock should be in the project area between late December and February. These fish migrate to the Snake and Clearwater Rivers from late summer to early winter, and all spawning activity should be completed by mid-December (Connor *et al.*, 1994). Currently, habitat from Snake RM 148.3 to RM 246.5, upstream from the confluence area, is annually surveyed for fall chinook salmon

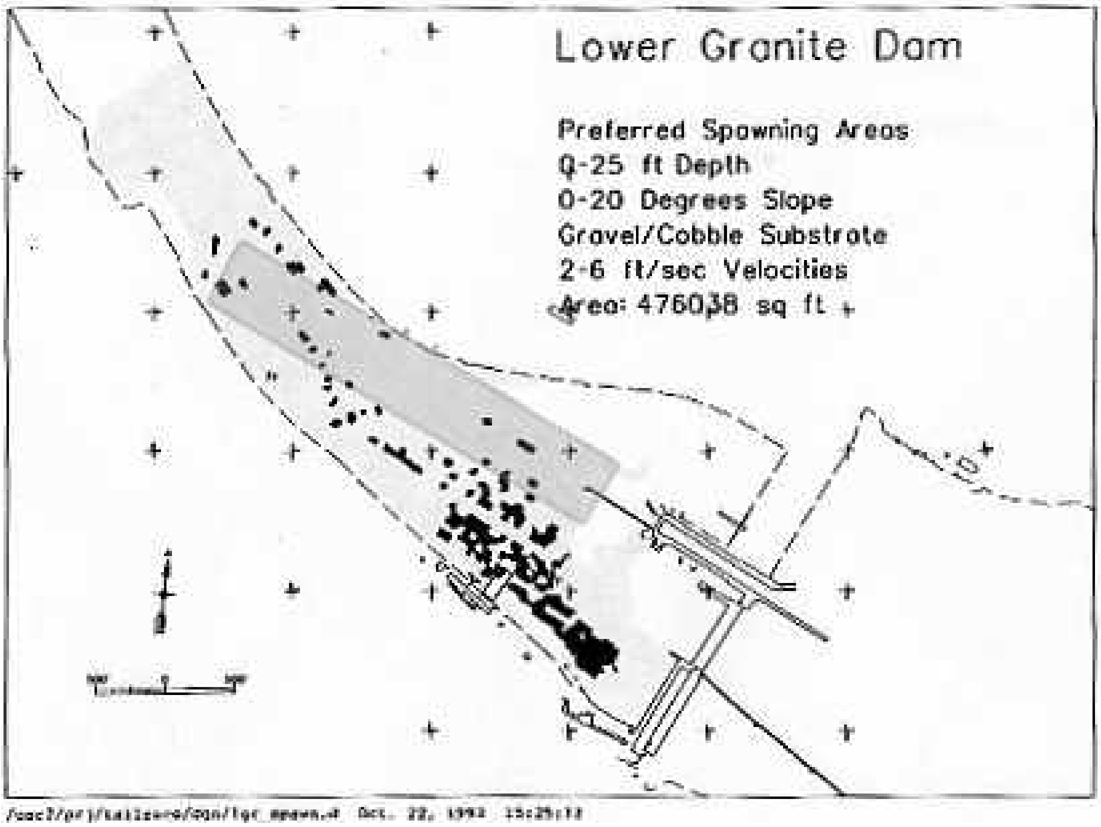


Figure 11. Lower Granite Dam Tailrace with potential spawning area designated by the black patches (based on substrate, velocity, depth and slope, Dauble et al, 1998) and the 2003-2004 proposed dredging footprint in dark gray.

redds by the USFWS Fisheries Resource Office in Ahsaka, Idaho (Garcia *et al.*, 1999). Although not examining the tailrace areas, no evidence of fall chinook salmon spawning has been found in the middle Snake River below RM 144 (Garcia *et al.*, 1999). The nearest redd location was a single redd in 1990, at Snake RM 148.3.

Placement of the dredged material at RM 116 is expected to be beneficial to fall chinook salmon. Criteria for the beneficial use of dredged material, based on the size of material placed and the depth of placement, was developed based on the research and monitoring recommendations of Dr. David Bennett, a researcher at the University of Idaho, who conducted monitoring studies regarding the effects of in-water disposal in the Lower Granite reservoir. Dr. Bennett's team found that sediments consisting of at least 80-percent sand, 0.008 inch (0.21 mm) in diameter or larger, is the preferred substrate for juvenile salmon. A depth of 20 feet (6.1 m) was determined as the boundary between mid-elevation depth and shallower water, based on typical limits of the photic zone conducive for primary and secondary productivity of food web constituents, as well as preferred depths of open sandy bench habitat important for juvenile fall chinook rearing (Bennett *et al.*, 1993a, 1993b, 1995a, 1997; Curet, 1994; Connor *et al.*, 1994; Rondorf and Miller, 1994).

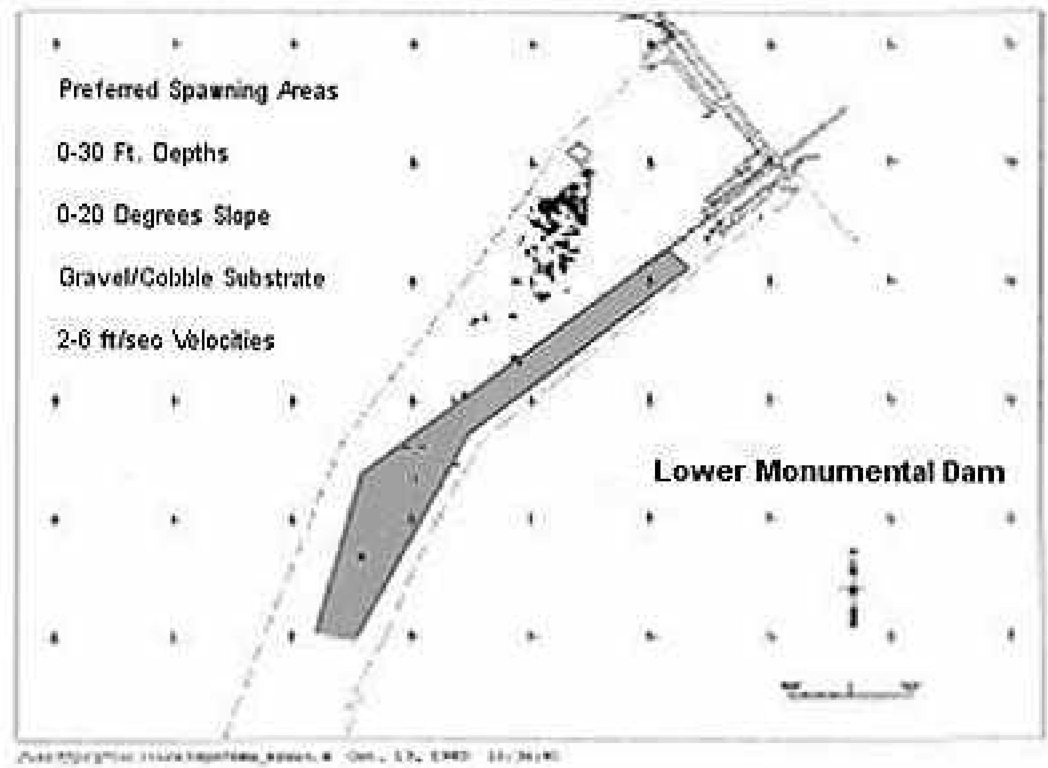


Figure 12. Lower Monumental Dam Tailrace with potential spawning area designated by the black patches (based on substrate, velocity, depth and slope, Dauble et al, 1998) and the 2003-2004 proposed dredging footprint in dark gray.

3.2.1.3 Effects of the Action

In addition to the shallow-water habitat, associated woody riparian habitat would be created along the shoreline. This habitat would be developed using the dredged material, placing the finer silt material on the sand embankment, and planting with native vegetation.

Wild Snake River fall chinook salmon typically outmigrate as subyearlings in the spring and summer of their emergence year. Based on the typical Snake River fall chinook salmon outmigration pattern, few, if any, juvenile chinook salmon would be present in the project areas during the dredging and disposal in-water work window.

Critical fish habitat in the lower Snake River (see Section 3.0.1) would be marginally affected by the dredging operations. Although the Corps knows of no standard definition of shoreline or shallow-water habitat other than depth, substrate, and slope characteristics, the Corps believes that dredging would not substantially lessen the amount of this habitat available to juvenile fall chinook salmon. All dredging would be less than 16 feet (4.9 m) below MOP, and most would occur in areas where only a few feet of sediment would be removed. Even after removal efforts, some sandy substrate would likely remain in the dredged areas. Benthic organisms in the dredged areas would be removed, but the benthic community should quickly re-establish in the dredged areas in 4 to 6 months (Bennett and Shrier, 1987; Bennett *et al.*, 1991 and 1997). The Corps anticipates that habitat quality at the proposed disposal areas would be greatly enhanced by placing dredged material to create shallow-water habitat, sand benches, and woody riparian habitat, thus benefiting Snake River fall chinook salmon.

3.2.1.4 Conservation Measures

Refer to Section 6.0, *Recommended Conservation Measures*.

3.2.1.5 Determination of Effect

The Corps believes that most life stages of the Snake River fall-run chinook salmon stock would be either unaffected or benefited by enhancing shallow-water rearing habitat and woody riparian habitat along the shorelines. At the proposed disposal site in the Lower Granite reservoir, the mid-depth bottom elevation would be raised to provide shallow-water conditions, with water depths of 0 to 10 feet (0 to 3 m). The resultant acreage of open, sandy shallow-water habitat and riparian vegetation should result in increased diversity of physical habitat and forage species preferred by rearing subyearling fall chinook salmon. Simultaneously, it should decrease habitat suitability for rearing of predator species (*i.e.,* smallmouth bass and northern pikeminnow).

The Corps believes that most life stages of the Snake River fall-run chinook salmon stock would be unaffected by habitat alteration within the project area, which is primarily used as a migratory corridor for juvenile and adult fall chinook. However, some juveniles (expected to be very few) may be overwintering in the project area during the dredging season.

The Corps has determined that dredging proposed for 2003-2004 in the lower Snake and Clearwater Rivers during the winter period of operation, "*may affect, and would likely adversely affect*" wild Snake River fall-run chinook salmon (Table 6).

This determination is based on the increasing potential for juveniles to overwinter in the confluence and shallow shoreline areas; and is supported by recent PIT-tag analysis, delayed growth evaluations, and seine capture data dating back to the early 1990's.

3.2.2 Snake River Spring/Summer-Run chinook salmon (*Oncorhynchus tshawytscha*)

3.2.2.1 Habitat Requirements/Population Status

The Snake River supports spring/summer chinook salmon, which were listed as threatened in April 1992. The lower Snake River corridor is designated as critical habitat for migration passage of wild Snake River Spring/Summer-Run chinook salmon. Critical habitat attributes and EFH components suitable for potential rearing or overwintering for Snake River spring/summer-run chinook salmon are likely present in the proposed project areas during the winter in-water work window. The components of designated critical habitat and EFH for juvenile and adult migration passage are present between mid-March and late August. No spawning habitat for wild Snake River Spring/Summer-Run Chinook Salmon is present in the proposed project area.

Table 6. Effects on Snake River Fall-Run Chinook Salmon by Life History Stage and by Dredged Material Removal Location for 2003-2004 Proposed Dredging.

Site Number*	Fall Ch egg to smolt	Fall Ch Smolt	Fall Ch adult passage	Fall Ch adult spawning
1	OW AA R AA	NAA	NAA	NAA
2a	OW AA R AA	NAA	NoE	NoE
2b	OW AA R AA	NAA	NoE	NoE
3a	OW AA R AA	NAA	NoE	NoE
3b	OW AA R AA	NAA	NoE	NoE
3c	OW AA R AA	NAA	NoE	NoE
3d	OW AA R AA	NAA	NoE	NAA
4a	OW AA R AA	NAA	NoE	NoE
4b	OW AA R AA	NAA	NoE	NoE

Notes:
F Ch = Snake River fall chinook salmon
OW = overwintering
R = rearing
NAA = Not Likely to Adversely Affect
AA = Likely to Adversely Affect
NoE = No Effect
* See the site listing in table F-5.

This ESU is comprised of a stock with an upriver spawning lifestyle that uses accessible tributary stream habitat at higher elevations, predominantly in the Salmon, Imnaha, and Grande Ronde sub-basins for spawning and rearing. Therefore, few individuals would be using the dredging activity areas of the Snake or Clearwater Rivers for rearing, feeding, or overwintering during the the designated in-water work period. The wild spring chinook salmon stock originally produced in the Clearwater River was extirpated early in the 1900's. The existing Clearwater River spring chinook salmon are hatchery-derived, without ESA status or protection.

3.2.2.2 Known Occurrences in Project Vicinity

A few individuals of spring chinook salmon (less than 20) have been documented as using the backwater areas of McNary reservoir for rearing, feeding, or overwintering (Easterbrooks, 1995, 1996, 1997, 1998) during the period sampled (mid-March through July). Although sampling has not occurred during the cooler water months in the lower Snake River, it is reasonable to assume that individuals of Snake River spring/summer-run chinook salmon could use the backwater areas of the lower Snake River reservoirs for periods of overwintering or rearing between July and March. Because this ESU is an upriver stock, no spawning habitat is present in the proposed project area.

Few wild Snake River spring/summer-run chinook salmon should be found in the project areas during the proposed in-water work window. Wild adult Snake River spring/summer-run chinook salmon migrate through the lower Snake River project area between April and mid-August. Therefore, no wild adult or juvenile Snake River spring/summer-sun chinook salmon would be present at the confluence of the Snake and Clearwater Rivers between late December and late February. Wild juvenile Snake River spring/summer-run chinook salmon generally migrate through the project area during March through July, but a few fish could be expected in backwater areas in the proposed work areas.

3.2.2.3 Effects of the Action

The proposed actions for the 2003-2004 dredging should have no discernable effect on the wild Snake River spring/summer-run chinook salmon stocks because few juvenile individuals of this stock would be present in the Snake or Clearwater Rivers during the winter in-water work windows. Although off-channel areas may hold overwintering fish, there should be no effect on individuals of the wild Snake River spring/summer-run chinook salmon stock through alterations of critical habitat caused by dredging, because this stock uses the proposed dredging areas primarily as migration corridors.

Placement of dredged material at RM 116 in 2003-2004 is expected to be most beneficial to Snake River fall chinook salmon, but increased production of macroinvertebrates as prey could also benefit migrating Snake River spring/summer chinook salmon.

Wild juvenile Snake River spring/summer-run chinook salmon out-migrate as yearlings in the following spring following their emergence year. Based on the typical out-migration pattern, few or no juvenile spring/summer chinook salmon should be present in the confluence of the Snake and Clearwater Rivers or the previously dredged tailwater area below the Lower Granite or Lower Monumental navigation lock guide walls during the dredging period.

3.2.2.4 Conservation Measures

Refer to Section 6.0, *Recommended Conservation Measures*.

3.2.2.5 Determination of Effect

Although dredging and disposal activities proposed for 2003-2004 would occur during a time of year that very few wild Snake River spring/summer-run chinook salmon stocks may be present, it is determined that the dredging and disposal operations "*may affect and are likely to adversely affect*" Snake River spring/summer-run chinook salmon due to the potential for this stock to overwinter in backwater areas during the in-water work window (Table 7).

Table 7. Effects on Snake River Spring/Summer-Run Chinook Salmon by Life History Stage and by Dredged Material Removal Location for the 2003-2004 Proposed Dredging Operation.

Site Number *	S/S Ch egg to smolt	S/S Ch smolt	S/S Ch adult passage	S/S Ch adult spawning
1	OW AA R AA	NAA	NAA	NoE
2a	OW AA R AA	NAA	NAA	NoE
2b	OW AA R AA	NAA	NAA	NoE
3a	OW AA R AA	NAA	NAA	NoE
3b	OW AA R AA	NAA	NAA	NoE
3c	OW AA R AA	NAA	NAA	NoE
3d	OW AA R AA	NAA	NAA	NoE
4a	OW AA R AA	NAA	NAA	NoE
4b	OW AA R AA	NAA	NAA	NoE
4c	OW AA R AA	NAA	NAA	NoE

Notes:
S/S Ch = Snake River Spring/Summer-Run Chinook Salmon
OW = overwintering
R = rearing
NAA = Not Likely to Adversely Affect
AA = Likely to Adversely Affect
NoE = No Effect

* See the site listing in table F-5.

In the event that wild Snake River spring/summer-run chinook salmon production increases under the NMFS 2000 Federal Columbia River Power System (FCRPS) Biological Opinion (BIOP), the passage dates for adult spring/summer chinook salmon would be similar to historical trend data. In addition, there should be no discernable effect on individuals of these stocks through alterations of Critical Habitat caused by dredging, because these stocks use the proposed dredging areas primarily as migration corridors.

3.2.3 Snake River Basin Steelhead (*Oncorhynchus mykiss*)

3.2.3.1 Habitat Requirements/Population Status

The lower Snake River supports wild Snake River Basin steelhead, which were listed as threatened on October 17, 1997. The lower Snake River corridor is designated critical habitat for migration passage of wild Snake River Basin Steelhead. Critical Habitat attributes and EFH components suitable for potential rearing or overwintering for Snake River Basin steelhead are likely present in the proposed project area. The components of designated critical habitat and EFH for juvenile passage is present between mid-March to August, kelt passage in March to June, and adult migration primarily between June and November. No spawning habitat for wild Snake River Basin steelhead is present in the proposed project area. This ESU is comprised of a stock with an upriver spawning lifestyle that uses accessible tributary stream habitat at higher elevations, in predominantly the Clearwater, Salmon, Imnaha, and Grande Ronde sub-basins, for spawning and most rearing.

3.2.3.2 Known Occurrences in Project Vicinity

Few individuals of wild adult or juvenile Snake River Basin steelhead would be present in the project area in late December, January, or February. Wild adult steelhead typically migrate through the reach between June and August for the A-run and between late August and November for the B-run. Wild adult Snake River Basin B-run steelhead migrating to the Middle and South Forks of the Salmon River for spawning in March through May could be present in mainstem channels adjacent to the project area during the time of dredging activities. Adults from this stock may be migrating in deeper water or individuals may be holding in mid-channel reservoirs prior to moving upriver into tributaries for spawning in early spring.

Wild juvenile Snake River Basin steelhead generally migrate through the lower Snake River, mostly between late March and the end of August. Because some rearing or overwintering may occur in the confluence area of the lower Snake and Clearwater Rivers, an unknown number of individuals could use the dredging activity areas of the Snake or Clearwater Rivers for rearing, feeding, or overwintering during the designated in-water work window.

3.2.3.3 Effects of the Action

The proposed 2003-2004 dredging activities would have negligible effects on the wild Snake River Basin steelhead stock because few individuals of this stock would be present in the Snake or Clearwater Rivers during the winter in-water work window. There could be minor effects on individuals of the wild Snake River Basin steelhead stock through alterations of critical habitat caused by dredging because, although this stock uses the proposed dredging areas primarily as migration corridors, some evidence indicates that the proposed dredging and disposal sites may serve as overwintering habitat.

Placement of dredged material at RM 116 in 2003-2004 is expected to be most beneficial to Snake River fall chinook salmon, but increased production of macroinvertebrates as prey could also benefit migrating juvenile Snake River Basin steelhead.

Wild juvenile Snake River Basin steelhead outmigrate in the second or third spring following their emergence year. Based on the typical Snake River Basin steelhead outmigration pattern, few juveniles would be present in the project area during the dredging period.

By the time the dredging operation begins in mid-December, the peak of steelhead fishing season has typically passed, and usually winds down by the first of January. This indicates that there are few, if any, steelhead present during the winter dredging operation, which should have only a minor impact on adult Snake River Basin steelhead.

3.2.3.4 Conservation Measures

Refer to Section 6.0, *Recommended Conservation Measures*.

3.2.3.5 Determination of Effect

Dredging and disposal operations in the project area proposed for the 2003-2004 period would occur during periods that Snake River Basin steelhead may be present. Due to possible overwintering behavior for both juveniles and adults in the project area, dredging activities "*may affect, and are likely to adversely affect*" Snake River Basin steelhead (see Table 8).

Table 8. Effects on Snake River Basin Steelhead by Life History Stage and by Dredged Material Removal Location for the 2003-2004 Proposed Dredging Operation.

Site Number *	SSTHD egg to smolt	SSTHD smolt	SSTHD adult passage	SSTHD adult spawning
1	OW AA R AA	NAA	AA	NoE
2a	OW AA R AA	NAA	NAA	NoE
2b	OW AA R AA	NAA	NAA	NoE
3a	OW AA R AA	NAA	NAA	NoE
3b	OW AA R AA	NAA	NAA	NoE
3c	OW AA R AA	NAA	NAA	NoE
3d	OW AA R AA	NAA	NAA	NoE
4a	OW AA R AA	NAA	NAA	NoE
4b	OW AA R AA	NAA	NAA	NoE
4c	OW AA R AA	NAA	NAA	NoE

Notes:
SSTHD = Snake River Basin Steelhead
OW = overwintering
R = rearing
NAA = Not Likely to Adversely Affect
AA = Likely to Adversely Affect
NoE = No Effect

* See the site listing in table F-5.

In the event that steelhead production increases under the NMFS 2000 FCRPS Biological Opinion, the passage dates for adult steelhead would be similar to historical trend data. In addition, there should be no discernable effect on individuals of these stocks through alterations of critical habitat caused by dredging because these stocks use the proposed dredging areas primarily as migration corridors.

3.3 Candidate or Proposed for Listing Species

None.

3.4 Species of Concern

The following species of concern are those listed by the USFWS that may have anadromous life stages either historically or currently, and may occur in the vicinity of the proposed project:

- Pacific lamprey *(Lampetra tridentata)*
- White sturgeon *(Acipenser transmontanus)*

Anadromous populations of these species would be of concern to NMFS, several tribes, and the Washington Department of Fish and Wildlife, but are only included under the purview of NMFS ESA review responsibilities. Analysis of effects could assist in preclusion to future listings under ESA. Of these species or their stocks, only white sturgeon have been widely documented to use the mainstem lower Snake River and the confluence of the Clearwater and Snake Rivers for rearing, feeding, or overwintering. Pacific lamprey use the project areas primarily as a migration corridor, but no surveys have been conducted for rearing ammocoetes. No known or documented spawning habitat is present in the proposed project area for either of the species. No designated critical habitat or EFH has been established by NMFS or USFWS for these species and/or their stocks.

3.4.1 Pacific Lamprey (*Lampetra tridentata*)

Spawning habitat requirements for Pacific lamprey are similar to those of salmonids, including clean gravel and cold water. After hatching from fertilized eggs, these fish spend about 5 years as ammocoetes (blind filter feeders); and burrow in mud and fine sediments in reservoirs, backwaters, and eddies, downstream from spawning riffles. The ammocoetes migrate slowly downstream, with their movement apparently triggered by high water flow. Between 4 and 6 years of age, ammocoetes metamorphose into adults, and become parasitic on soft-scaled fish. The adults migrate to sea, where they remain until they return to fresh water to spawn and die.

Many questions have yet to be answered about Pacific lamprey in the Columbia River Basin. Although ammocoetes settle out downstream from spawning riffles, the distance downstream that ammocoetes would drift before settling out and burying into the substrate has not been determined. If drift potential includes a substantial distance and ammocoetes migrate slowly downstream with flow, rearing Pacific lamprey would likely be present in some of the areas proposed for dredging. The primary area of concern would be the confluence of the Snake and Clearwater Rivers. Because the ammocoetes settle out in backwater areas, the thalweg may not be heavily populated.

3.4.2 White Sturgeon (*Acipenser transmontanus*)

In the lower Snake River, white sturgeon use depths from primarily 20 to 130 feet (6.1 to 39.6 m) with highest catch rates at intermediate depths of 59 to 72 feet (18 to 22 m). Water velocities used by white sturgeon range from 0 to 2 feet/second (0.0 to 0.58 meter/second), with a maximum suitability index for mean and near-substrate velocities near 1.2 feet/second (0.38 meter/second). Substrate use is predominantly sand.

Habitat use by white sturgeon in the Lower Granite reservoir indicate a high tolerance of habitat conditions. Catch rates and suitability indices indicate white sturgeon use habitat at the upper end of the Lower Granite reservoir with greater frequency than mid- and lower reservoir transects. These upper areas coincide with higher water velocity, large sand substrate, and shallower depths relative to transects sampled downriver.

Stepwise discriminate analysis of habitat variables indicate that maximum depth, near-substrate water velocity, near-substrate dissolved oxygen concentrations, and sand substrate provide best separation between presence and absence of white sturgeon (Lepla, 1994). However, only 26 percent of the variation between locations classified as present or absent are explained by the habitat variables measured, suggesting other criteria are responsible for white sturgeon distribution in the Lower Granite reservoir (*i.e.*, prey abundance and availability).

Deep-water areas of 76.8 to 159.8 feet (23.4 to 48.7 m) at mid- and lower sections of the Lower Granite reservoir were not considered significant, since use of these areas by white sturgeon was markedly lower than at upstream locations. Approximately 77 percent of the white sturgeon collected were in the thalweg, with highest catch rates (0.23 to 0.32 fish/hour) at upper reservoir transects (RM 134 and RM 137.3). where maximum depths were less than 75.5 feet (23 m).

Use of thalweg and areas adjacent to the thalweg by white sturgeon were similar between day and night sampling. Seasonal differences in catch rates were not significant for mid- and lower reservoir transects, where abundance of white sturgeon was consistently low.

4.0 CUMULATIVE EFFECTS

4.1 The PFC Pathways and Indicators

4.1.1 Benthic Invertebrates

The newly-placed disposal material may type-convert and enhance the existing marginal-quality rearing habitat along the shoreline. Some benthic invertebrates inhabiting the dredged material would be displaced and colonize the disposal sites. The seasonally-productive benthic communities would quickly re-establish with the same species composition and abundance shortly after the effects of construction have subsided and the next growing/production season returns. No additional displacement over seasonal background levels should occur or persist.

4.1.2 Water Quality

Increases in turbidity and debris from equipment operation during removal and disposal of the dredged material should be expected. Any unanticipated impacts due to dredging activities should be minimal and localized, and would be regulated by direct monitoring. The comparison of activity parameter levels against background levels would be done according to the conditions set forth by the Washington Department of Ecology, and the Corps would be required to meet State of Washington water quality standards.

Some immeasurable degree of competition for food or predator avoidance can be expected for the a few months following construction. This effect may transfer into a slight reduction in the ability of part of the population to successfully produce a high rate of weight gain during the late-spring, post-construction activity period. Any permit requirements for water quality certification should also act to directly protect fishery resources that would be present or in the near vicinity.

4.1.3 Habitat Access

The proposed dredged material removal and disposal should pose no effect to impeding access to the migration corridor and/or tributary or backwater-rearing habitat for any listed salmon or steelhead stock.

4.1.4 Habitat Elements

The proposed action of enhancing rearing habitat both quantitatively and qualitatively, and with a better distribution spatially, could have long-term benefits to the anadromous and resident fishery resources within the lower Snake River. No long-term negative impacts are anticipated, and the proposed action should increase overall fish population health and abundance. Negative impacts due to the proposed dredged material removal and disposal activities are expected to be short-term concerns that would be adequately monitored in real-time, in accordance with state and Federal water quality criteria. Short-term environmental impacts may include mild localized and incremental increases in turbidity and possible organic waste solids and liquids from equipment operation of dredge platforms. Control provisions would be in place to minimize adverse impacts of construction on the environment (*e.g.*, contractors are required to comply with all applicable environmental laws). Any permit requirements for water quality certification would also act to directly protect fishery resources present in the work area.

Construction activity would involve noise from heavy equipment and human activity. Disturbance to fishery resources should be minimal, when compared to the existing condition. Biological organisms respond to disturbance either by avoidance or habituation. Short-term disturbance would probably cause temporary avoidance, but would have no long-term effects. Species that cannot avoid disturbance may become habituated if they are present near the construction activities.

4.1.4.1 Dredging Sites

The existing habitat suitability for anadromous salmonids at the proposed dredging locations is marginal. In both the confluence area and other sandy areas in the navigation channel, water velocity and the repeated dredging actions performed since 1975 have combined to make this a less preferred habitat for juvenile salmonids. In the backwater areas of the Snake River reservoirs, much of the substrate is silt, which is also a less preferred habitat. Therefore, dredging these areas is not expected to adversely impact the critical habitat for these species.

4.1.4.2 Disposal Site

The proposed in-water disposal site is designated critical habitat for all Snake River Basin salmon and steelhead ESU stocks (Federal Register, February 5, 1999, Volume 64, Number 24). Disposal actions would not likely adversely affect any adults or juveniles of these stocks. The shoreline and shallow-water habitat enhancement proposed would not negatively affect the suitability of that habitat for rearing or resting Snake River fall chinook and/or Snake River Basin steelhead. Habitat-dependent early life stages of fall chinook salmon would likely only use the existing mid-depth shoreline area minimally, due to previous impacts and type conversion from a combination of reservoir filling and riprap shoreline protection that directly transitions into open water. Beneficial disposal to create a riparian bench and shallow-water habitat is designed to increase the quantity, distribution, and quality of rearing habitat sites in the reservoirs for all salmonid species, but most improvements would primarily benefit fall chinook salmon.

4.2 Indirect Effects, Interdependent Effects, or Interrelated Effects

Based on over 10 years of data, all anticipated indirect effects, interdependent effects, or interrelated effects would likely not be significant because they either currently exist in state or are due to the existing human impact regime. The experimentation data compiled by Dr. David Bennett, and associated University of Idaho research and monitoring, indicate that the previous loss of shoreline sandbar habitat could be mitigated. The studies conducted by Dr. Bennett indicate that there may be beneficial uses of the dredged material in the reservoir as long as certain criteria are followed in the selection and placement of the material.

Dredging of boat basins and access to such basins should provide little increased use in the number of net recreational boats or commercial boating ventures. Since the depth of the navigation channel and all access channels remains relatively shallow, at 14 feet (4.3 m) for shallow draft vessels, it is anticipated that very few deeper draft vessels would be capable of utilizing the dredged areas.

Without disposal at Knoxway in 2003-2004, the existing site would result in the status quo with about 2 inches (5.1 cm) per year of fine sediment accumulating across the bench. Therefore, there would be no improvement in rearing habitat suitability from the current poor rating. Considering the cultural resource protection limitations, the potential rearing habitat created may have some structural diversity in bottom geometry without vegetative cover conducive to predator species rearing or hiding.

5.0 INCIDENTAL TAKE

The incidental take of endangered anadromous salmonid individuals is expected to be low and to vary by species, but no major impacts to any of the stocks are expected. Few, if any, of these stocks should be occupying or utilizing reservoir habitats during the proposed in-water work periods. No significant adverse effect that could result in Incidental Take of Snake River sockeye is anticipated. The potential exists for adverse effects in limited Incidental Take of possibly a few Snake River spring/summer or fall chinook salmon and/or Snake River steelhead. An unknown number of overwintering juveniles of these stocks could be occupying or utilizing lower Snake River habitats during the in-water work window, and a few adult steelhead may be in the vicinity of some dredging activities.

6.0 RECOMMENDED CONSERVATION MEASURES

6.1 Habitat Improvement Measures

The prominent habitat improvement measure relies primarily on in-water disposal of dredged material and the creation of shallow-water and mid-depth habitat with the dredged material. Implementation of this measure would benefit aquatic resources and, in particular, endangered salmonid species. The Corps would conduct long-term physical monitoring of shallow-water and mid-depth disposal sites to evaluate the success and quality of habitat creation.

Disposal of dredged material is designed for beneficial use. Silt/sand mixes would be placed at the Knoxway Canyon bay site (RM 116) as a base for a riparian planting bench upland, coupled with an aquatic bench with a +10-foot-deep (3.0-meter-deep), capping layer of material that is at least 80-percent sand. Cobbles and larger gravels removed from the navigation lock approaches would be placed as armoring against wave action along the riverward slope of newly created shallow-water habitat. The proposed placement of dredged material would act to restore lost shoreline and shallow bar rearing habitat used by juvenile Snake River fall chinook salmon, and should result in long-term benefits to anadromous fish production and survival within the lower Snake River migration corridor.

Natural shallow sloping shoreline beaches represent preferred shallow-water habitat for fall chinook. Criteria would include a slope of 3 to 5 percent, of primarily less than 10 feet (3 m), from near the water's edge down to 20 feet (6.1 m) at the deepest edge within the river channel. Substrate surface should be predominately open sand that is relatively smooth throughout its distribution, without the hummocking resulting from simple split-bottom barge load dumping. This would require smoothing by dragging a beam subsurface from a small- to medium-size tug, thus establishing that 3- to 5-percent slope from the near shore edge riverward. This dumping/smoothing sequencing would need to be done in phases, working riverward from near the water's edge to the maximum 20-foot (6.1 m) depth.

Cobbles, silt, and silt/sand mixture placement in 2003-2004 would occur in a manner that would extend the shore riverward along the proposed disposal site (RM 116). This would ultimately result in the creation of a planting bench for riparian species that would submerge within the water surface elevation range (between 736 and 738 fmsl). The overall plan is to place the sands in the below-water portion extending riverward of the riparian embankment. Riverward to the riparian bench, sand would be placed to enhance the rearing suitability of the mid-depth habitat bench, decreasing the depth at a 1-vertical to 10-horizontal slope across the newly created shallow-water rearing habitat. Cobbles from the dredging of the navigation lock approaches would be placed around the perimeter of the bench in a 1-foot thick by approximately 30-foot-wide band to cover the maximum fluctuation in pool elevation (between elevation 732 and 736). The cobbles would cover about 1/4 to 1/6 the total width of the shallow-water habitat, acting as armoring to protect the bench from wave action from the wind or passing barges/boats. Cobble placement would start at the upstream end of the bench, where it would be tied into the existing shoreline.

6.2 In-Water Work

All work would be completed within the established in-water work window of 15 December 2003 through 1 March 2004 unless alternative dates outside of this window are approved by NMFS.

6.3 Pre-dredging Surveys and Biological Studies

Prior to dredging, the lock approaches of the two lower Snake River dams would be surveyed for redds according to established protocol (Dauble *et al*., 1995). If redds were found and verified, discussions with NMFS would be held prior to commencing dredging at these locations, and location and duration of dredging would be modified to accommodate avoidance and protection of any verified redds.

In addition, biological monitoring of the disposal site and newly created shallow-water habitat would be conducted to document the long- and short-term benefits to anadromous salmonids by the creation of this habitat. Monitoring of the created habitat may include studies similar to those conducted by Dr. Bennett to determine use of these areas by invertebrates, resident fish, and anadromous fish and would be included in any future budget requests.

6.4 Water-Quality Monitoring Plan

Water quality monitoring will be performed by the Corps' dredging contractor. The contractor will be required to hire an independent water quality monitoring service to perform the monitoring. The monitoring service shall be regularly engaged in the business of water quality sampling and testing, and shall have a minimum of 5 years of experience in water quality monitoring for the parameters specified, using equipment and methods that meet this specification.

Water quality monitoring equipment, listed below, will be furnished by the contractor and be used for monitoring of all dredging and disposal activities:

- Depth sensor to measure exact position in the water column. The sensor shall have a range of between 0 feet and 100 feet, with a resolution of 0.01 feet and a minimum accuracy of 0.4 feet.
- pH sensor accurate to 0.2 pH units, with a resolution of 0.01 units
- Turbidity sensor accurate to 5 percent of identified range for the equipment, or 2 NTUs, whichever is greater.
- Dissolved oxygen sensor accurate to 0.2 mg/L of the "Clark" type polar graphic design.
- Specific conductance electrode to complement dissolved oxygen measurements.
- Temperature sensor accurate to 0.15 degree Celsius with a resolution of 0.1 degrees Celsius.
- Ammonia sensor accurate to +/- 0.2 mg/L.

All equipment will be calibrated prior to use, and will be recalibrated at the manufacturer-recommended interval for each piece of equipment and whenever there is any indication that the equipment is not performing properly. Calibration of the instruments will be in accordance with the equipment manufacturer's specifications, using recognized industry standards.

Prior to commencement of any in-river dredging or disposal operations, the contractor will submit a Water Quality Monitoring Plan for approval by the Corps. The plan will include, as a minimum, the following:

- Company name, address, and phone number of water quality testing service;
- resumes of water quality testing personnel;
- equipment list for all water quality testing equipment and materials;
- manufacturer's specifications for each piece of water quality testing equipment to be used;
- calibration history for each piece of equipment to be used; and
- detailed narrative of personnel, equipment, and activities proposed for performance of water quality monitoring.

6.4.1 Monitoring Locations

Monitoring locations for all parameters will follow the specifications in Washington Administrative Code (WAC) 173-201A and the ESA consultation with NMFS. In general, monitoring will be performed at a point 300 feet upstream of the work areas to determine background levels; and at points 300, 600, and (if specified) 1,200 feet downstream of the work areas to determine water quality effects. For dredging activities, distances will be measured from the clamshell bucket, +/- 30 feet, when the swing arm is pointing downstream. Monitoring stations will have to be relocated each time the dredge shifts anchor points downstream or upstream. For disposal activities, distances will be measured from the point of discharge, +/- 30 feet. Specific locations of monitoring stations are listed below:

- Navigation lock approach dredging
    - One station, 300 feet upstream of dredging activity, for background
    - For background when dredging within 300 feet of the upstream end of the navigation lock approach, one station adjacent to the dam inside the navigation guidewall
    - One station, 300 feet downstream
    - One station, 600 feet downstream

- Navigation channel dredging including Port of Lewiston and Port of Clarkston
    - For dredging in the Clearwater River to point N 417,651/E 2,873,899 at the confluence of the Snake and Clearwater Rivers (see Figure 1), one station 300 feet upstream for background
    - For dredging in the Snake River up to 300 feet downstream of point N 417,651/E 2,873,899, one station 300 feet upstream in the Clearwater River and one station 300 feet upstream in the Snake River. Use the station with the higher readings as background.
    - For dredging in the Snake River 300 or more feet downstream of point N 417,651/E 2,873,899, one station 300 feet upstream in the Snake River for background
    - One station, 300 feet downstream
    - One station, 600 feet downstream
    - When dredging within the port areas, one additional station 1,200 feet downstream

- Boat basins (Willow Landing, Illia Landing, Greenbelt, and Swallows)
    - One station in the main river channel, 300 feet upstream of entrance to boat basin, for background
    - One station in the center of the boat basin, taking readings 3 feet from water surface only

- One station at the entrance to the boat basin, taking readings 3 feet from the water surface only
- One station in the main river channel, 300 feet downstream from entrance to boat basin
- For Greenbelt boat basin only, one additional station in main river channel 600 feet downstream from entrance to boat basin

- Swallows Swim Beach

  - One station in main river channel, 300 feet upstream of upriver entrance, for background
  - One station in center of swim area, 3 feet from water surface only
  - One station at downriver exit, 3 feet from water surface only
  - One station in main river channel, 300 feet downstream from downriver exit

- Disposal area

  - One station, 300 feet upstream, not to exceed 500 feet from shore for background
  - One station, 300 feet downstream
  - One station, 600 feet downstream
  - One station, 1,200 feet downstream

6.4.2 Sample Timing

The timing of sampling are planned as follows:

- For 1 hour prior to work at each dredging location and at the disposal site, background levels will be measured. Readings will be taken every 5 minutes. Additional pre-activity levels will be measured when work has stopped for more than 1 day, as necessary, to determine pre-activity levels prior to commencement of work at the site.

- During all turbidity-creating activities, near real-time water quality monitoring will be performed. Equipment will be set up in a manner to allow the results to be monitored by the Corps and the contractor. Readings will be taken every 5 minutes.

- For 1 hour following completion of work at each dredging site, and the disposal site, post-activity levels will be measured. Readings will be taken every 5 minutes.

The contractor would, immediately upon determining any exceedance of the NTU limit, alter the dredging operation and continue monitoring turbidity at the downstream location until NTU levels to returned to an acceptable limit above background. If NTU levels did not return to an acceptable limit, the contractor would stop dredging and wait for NTU levels to drop before resuming dredging. If unable to alter the dredging operation to meet turbidity requirements, the contractor would contact the Corps for further instructions.

Following completion of all dredging and disposal activities, the contractor will submit a final water quality monitoring report, prepared by the independent water quality testing service. The report will contain all data collected during dredging and disposal operations, and will be prepared using the most current version of Microsoft Excel spreadsheet software, unless otherwise approved. The format of data in the report will be recommended by the independent testing service, and approved by the Corps. The location and date of sampling will be included for all data in the report. The final report will be submitted in both electronic form (on compact discs) and as hard copies.

6.5 Substrate Quality

A concern with the quality of the substrate removed from boat basins is the potential for the accumulation of bound contaminants in the silt. These often occur because of spilled gasoline and oils used to operate watercraft, or are brought downriver to settle in the lower velocities of the backwater eddy environments. Sampling in 2003 indicated the oil and grease content of the sediments ranged from 70 mg/L (Illia Boat Landing) to 817 mg/L (Greenbelt Boat Basin). The Port of Clarkston and Greenbelt Boat Basin had the highest calculated averages of 465 mg/l and 483 mg/L, respectively.

Since the natural organic breakdown products from plant and animal matter contribute to the oil and grease content, TPH for diesel and motor oil were completed to identify those components. The values reported for TPH diesel at the Port of Lewiston, Illia Boat Landing, and Willow Boat Landing were all less than detection limits. Five of the six samples from the Port of Clarkston, all three from Greenbelt Boat Basin, and two of the sixteen from the Snake River below the confluence had concentrations that ranged from 28 to 82 mg/L. The TPH motor oil results paralleled the TPH diesel data, but were four to five times higher.

The concentrations of petroleum products in dredged sediments are not the primary determinant for in-water disposal. The interim lower Columbia River testing framework does not consider petroleum products a contaminant, and no screening levels are available from the framework. Rather, current regulations rely on chemical tests for PAH compounds in the material to determine suitability for unconfined aquatic disposal. However, the presence of oil and grease in dredged material may be a consideration if the material is to be placed upland.

If dredged material has contaminants that exceed limits defined by water quality standards for in-water fill, but do not reach regulatory action levels requiring hazardous waste classification, it would be placed at an upland disposal site. In the event that dredged material has levels of contaminants above regulatory action levels, or if a pocket of visually-contaminated sediments is hauled up in the clamshell or bucket, the

Corps would direct that such an area be classified and investigated as Hazardous Waste and deposited in a truck for removal to an appropriate established waste disposal site (likely a landfill). Upon visual inspection of wet sediment, the presence of organic fuel products is readily apparent due to the multi-colored shine, smell, or oily feel of such material. This was observed while dewatering some marinas stranded during the 1992 reservoir drawdown test of the Lower Granite and Little Goose reservoirs.

6.6 Newly Created Habitat Stability Testing

Monitoring performed within 6 months of completing dredging and disposal activities will consist of sediment sampling by the dredging contractor at the disposal area to determine grain size composition of the materials and to verify the in-place conditions of the sediments. For the woody riparian planting bench, this sampling will occur after the sediments consolidate enough to allow equipment to travel across the surface of the disposal area. For the underwater portion of the site, this sampling will occur anytime starting one day after the last deposit of dredged material and will be completed prior to the end of the in-water work window (March 1, 2004). The contractor will have until the July 31, 2004 to complete the sampling of the upland portion of the site. Grain size analysis will be completed by August 31, 2004.

Sediment samples will be taken by the contractor using vibracore drilling. Prior to starting work the contractor will submit a plan for drilling, sampling, testing, and safety. The plan will include, but not be limited to, a description of the equipment and sampling tools that will be used and a plan detailing the location and depths of each vibracore. This submittal will also include a statement of the prior experience of the persons designated to perform the work specified. The contractor will submit complete, legible copies of drilling logs and records to the Corps upon completion of the work. The contractor will also submit all non-tested core samples and a compilation of all sample descriptions, photographs, and analyses in a complete, legible format.

Vibracoring will be performed in accordance with ASTM D 4823 using a minimum 3.0-inch inside diameter. Samples will extend from the surface of the new embankment to the original ground surface elevation. All samples will be obtained using vibracoring devices complete with graph-type depth and rate of penetration recorder. The coring device will recover a minimum of 80 percent of all material penetrated to be an acceptable boring. The vibracoring device will be collected and retained. The liners will be cut in five-foot sections and sealed at both ends and marked to indicate hole number, top and bottom elevations, and location. The sample liners must be stored in a vertical position and must be transported in a vertical position. The liners must be handled and stored in such a manner that a minimum of disturbance of the contained sediments occurs.

Samples will be obtained to the original ground surface elevation. When located over a boring site, the contractor will make every reasonable effort to reach the required depth or to reach penetration refusal. Penetration refusal will be considered when less than one foot of advance is accomplished after five minutes of vibration with vibrating type coring tool. When advancing the sampling device and refusal is reached at depths less than designated, the contractor will be required to continue sampling by a combination of vibration and jetting. Where it is determined that refusal is not due to obstruction, the partially filled core liner will be removed and a new one jetted. Jetting will be required to return the core pipe to the depth of previous refusal whereupon jetting will be ceased and additional vibration sampling will be commenced. This process will be repeated as many times as required to obtain the designated depth. However, generally three attempts is the maximum required.

The contractor will submit a plan, to be approved by the Corps, showing the locations and depths of all borings. Before each vibracore is taken, the exact position and the water depth at that point will be recorded. Water depths will be obtained by a fathometer capable of resolution to the nearest tenth of a foot. The fathometer will be calibrated by the bar check method at the beginning and end of each day's work. The positioning of the vessel relative to the sample site locations will meet reasonable standards outlined in the Corps of Engineers Hydrographic Surveying Manual, EM 1110-2-1003 for Class 1 surveys. All elevations and depths will be referenced to the National Geodetic Vertical Datum adjustment of 1929 (NGVD29). All horizontal positions will be referenced to the Washington Coordinate System (WCS), South Zone, North American Datum adjustment of 1927 (NAD27).

Sampling will commence on the line perpendicular to the shoreline at 100 feet downstream from the upstream edge of the disposal area (Figure 2). Core samples will be taken along this line as follows:

Core A – riparian bench midpoint
Core B – resting/rearing habitat midpoint
Core C – midpoint of the embankment slope

In general, this alignment and array of holes will be repeated at an evenly spaced interval, about 200 feet apart, along the length of the embankment so the last line will be at the point 100 feet upstream of the downstream edge of the disposal area. Two holes may be located in the embankment slope on the downstream edge of the disposal area.

7.0 ADDITIONAL AREAS OF CONSIDERATION

7.1 Federal Columbia River Power System (FCRPS) 2000 Biological Opinion (BIOP)

On December 21, 2000, NMFS issued the FCRPS BIOP (NMFS, 2000), which serves as the environmental baseline against which actions such as the DMMP and Woody Riparian programs would be compared and measured for determination of effects. In the proposed dredging area, the NMFS Biological Opinion found that the FCRPS jeopardizes the continued existence and survival of endangered Snake River sockeye, threatened Snake River fall-run chinook, threatened Snake River Spring/Summer chinook, and threatened Snake River basin steelhead. To avoid jeopardy, Federal agencies regulating the FCRPS were provided a number of Reasonable and Prudent Alternatives (RPAs). In the RPAs, NMFS identified four categories of actions where survival and recovery of listed salmonids may be enhanced: hydroelectric, habitat, harvest, and hatcheries. It is important to note that a number of the RPAs involve off-site mitigation (*e.g.*, habitat improvements in estuaries and mainstem tributaries). Modifying hydroelectric actions alone is insufficient to avoid jeopardy. Habitat improvements are also necessary. The creation or restoration of critical components of habitat (*e.g.,* such as shallow-water rearing habitat for Snake River Fall chinook salmon with disposal of dredged material) provides positive contribution to the RPAs.

7.2 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act is the principal law governing marine fisheries in the United States. It was adopted to extend control of U.S. waters to 200 nautical miles in the ocean; to phase out foreign fishing activities within this zone; to prevent over fishing, especially by foreign fleets; to allow over-fished stocks to recover; and to conserve and manage fishery resources. In addition, Section 104-297 indicates that one purpose of the act is to promote the protection of EFH, in the review of projects conducted under Federal permits, licenses, or other authorities that affect or have the potential to affect such habitat. The EFH describes those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. Adverse effect means any impact, which reduces quality and/or quantity of EFH, and may include direct (*e.g.*, contamination or physical disruption), indirect (*e.g*., loss of prey or reduction in species fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Detailed descriptions and identifications of EFH for salmon are found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan. Pursuant to Section 305(b)(4)(A) of the Magnuson-Stevens Act (50 CFR 600), NMFS is required to provide EFH conservation recommendations to Federal agencies regarding actions which may adversely affect EFH.

7.3 Land Use and Shoreline Development

The project area is affected by a range of land uses and varying levels of shoreline development. Cropland, marinas, docks, residential dwellings, roads, railroads, rip-rap, and landscaping have displaced natural habitat features. This land use and shoreline development has primarily affected the original Habitat Elements and Channel Condition and Dynamics pathways . In general, shoreline development has reduced the quality of nearshore salmonid habitat by eliminating native riparian vegetation (contributing to the *not properly functioning* status for Large Woody Debris and Refugia indicators); displacing shallow-water habitat with fill materials (contributing to the *not properly functioning* status for the Off-Channel Habitat indicator); and by further disconnecting the Snake and Columbia Rivers from historic floodplain areas (contributing to the *not properly functioning* status for the Floodplain Connectivity indicator). Additionally, agricultural land use (*e.g.*, grazing, growing crops, irrigating) has reduced the quality of riparian buffers and the stability of soils adjacent to rivers and streams. Without adequate buffers and effective soil stabilization, sediments are easily eroded and transported to surface waters where they accumulate (sedimentation). Although smaller tributaries may be affected initially, erosion and sedimentation ultimately affect mainstem portions of the Snake and Columbia Rivers.

8.0 CONCLUSIONS AND DETERMINATION OF EFFECT

The Corps requests formal consultation with NMFS, under Section 7 of the ESA, for these proposed activities. Based on the above information, the Corps has determined that the above described actions *"May Affect, But Are Not Likely To Adversely Affect"* individuals of Snake River sockeye; and *"May Affect, And Are Likely To Adversely Affect"* Snake River spring/summer and fall chinook salmon, and/or Snake River Basin steelhead ESUs. It is also likely that the proposed action would not act to jeopardize their continued existence, or act to preclude their survival or recovery through potential adverse modification of rearing and migration components of their Critical Habitat. This determination is based on all work being performed within the designated winter in-water work window. The dredged material removal and disposal activities and their effects (*e.g.*, such as short-term turbidity plumes) should be easily avoidable by either juvenile or adults of any listed salmonid stock that would be rearing or migrating within the mainstem Snake River. The mechanical dredging activities should be harmless. The Corps also believes that the in-water disposal activity of adding dredged material to increase the elevation of the current mid-depth bench in the Lower Granite reservoir would not adversely affect critical habitat for the listed stocks of Snake River chinook and sockeye salmon or Snake River steelhead; and should be beneficial to Snake River fall chinook salmon juvenile rearing through increasing available, suitable, and functional habitat in open sand with increased macroinvertebrate production.

Although little is known about Pacific lamprey use of the main stem Snake River, if the preceding statements prove accurate, most types of dredging could have impacts on rearing Pacific lamprey. Both hydraulic and mechanical methods may entrain juvenile lamprey, and the deposition of material could have the potential to bury lamprey in the reservoir. Monitoring of dredged material may be required in the future to determine impacts to various life stages of these fish.

Some white sturgeon habitat could be displaced by conversion to shallow-water habitat that would be more suitable for fall chinook salmon rearing. However, overall impacts due to dredging and disposal are thought to be minimal.

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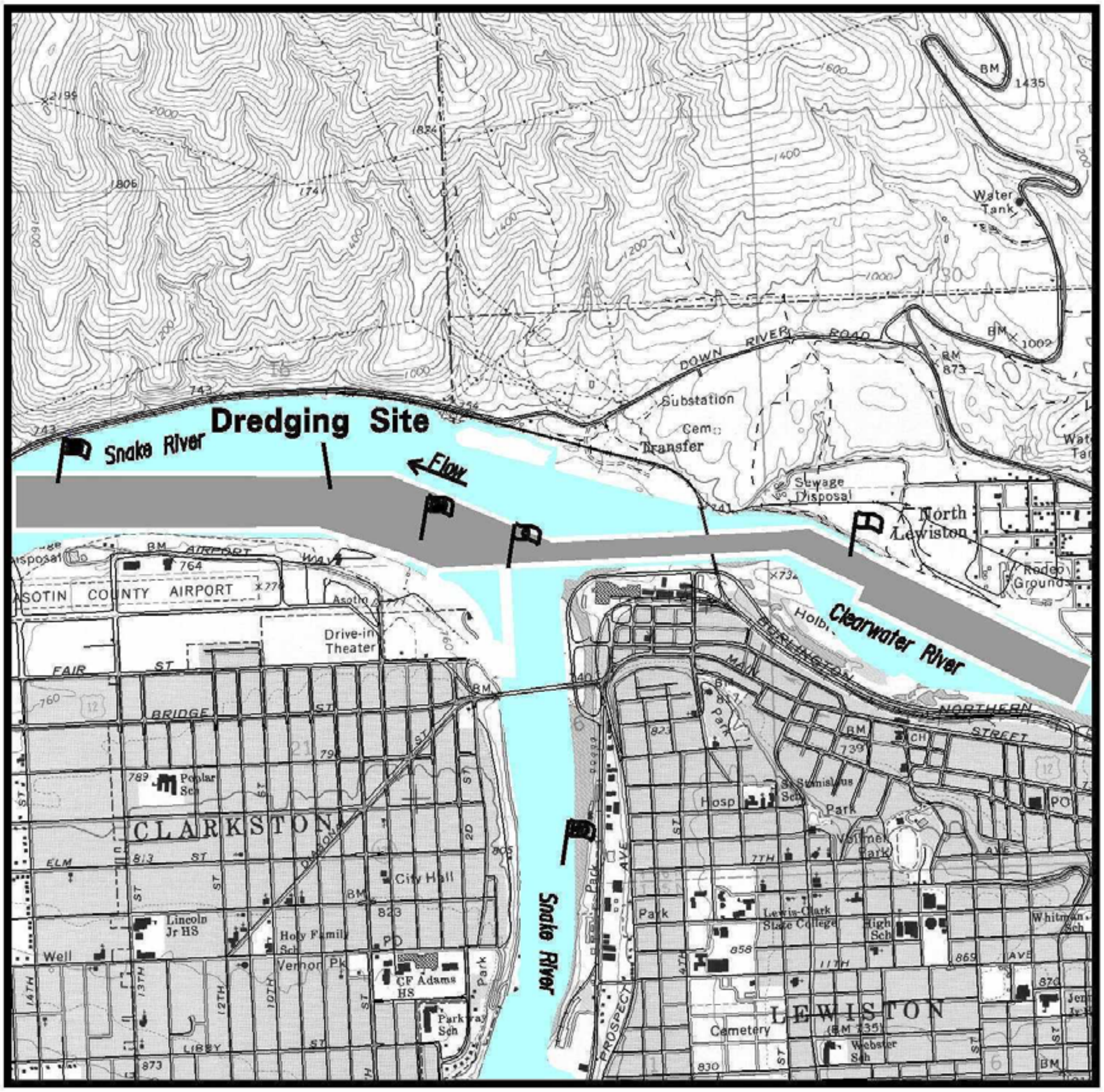
PLATES



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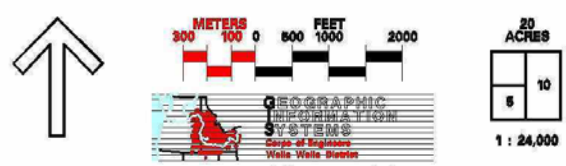

Clarkston, WA. USGS 7.5 Minute Quadrangle. Township 11 N, Range 46 E.

Walla Walla District

Lower Snake River Reservoirs and McNary Reservoir Dredged Material Management Plan

Winter 2003-2004 Dredging Plan

SNAKE AND CLEARWATER CONFLUENCE SITE

2002

Plate 1

GIS Analysts & Graphic Assembly: Applied Technology Team (CENWW-PM-PD-E-AT)
GIS Applications Coordinator: Blaise Grden (CENWW-PM-PD-E-AT)

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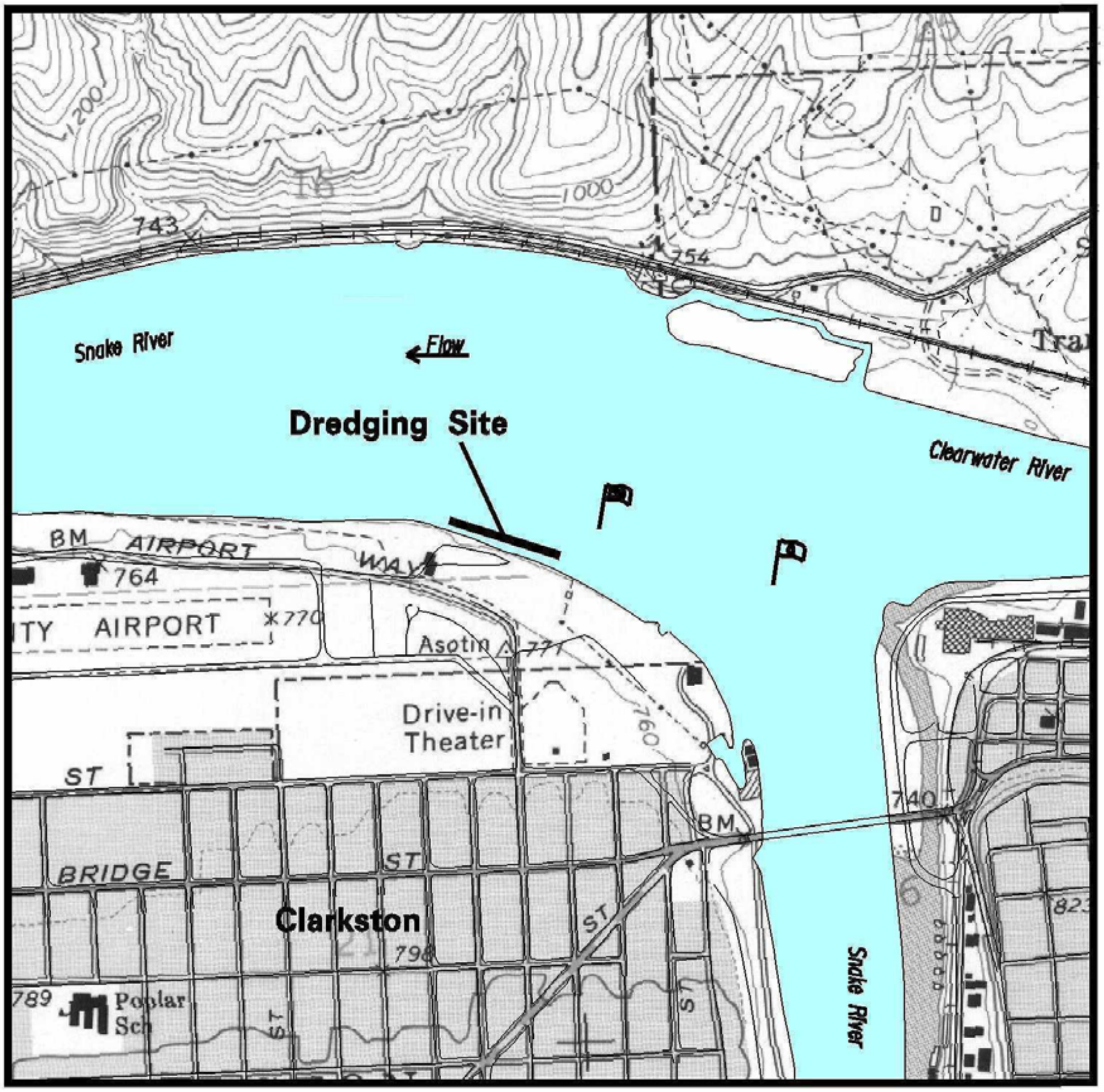

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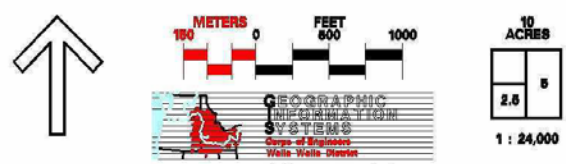

Clarkston, WA. USGS 7.5 Minute Quadrangle, Township 11 N, Range 46 E

Walla Walla District
Lower Snake River Reservoirs and McNary Reservoir Dredged Material Management Plan
Winter 2003-2004 Dredging Plan

PORT OF CLARKSTON SITE

2002

Plate 2

GIS Analysis & Graphic Assembly: Applied Technology Team (CENWW-PM-PD-E-AT)
GIS Applications Coordinator: Blaise Grden (CENWW-PM-PD-E-AT)

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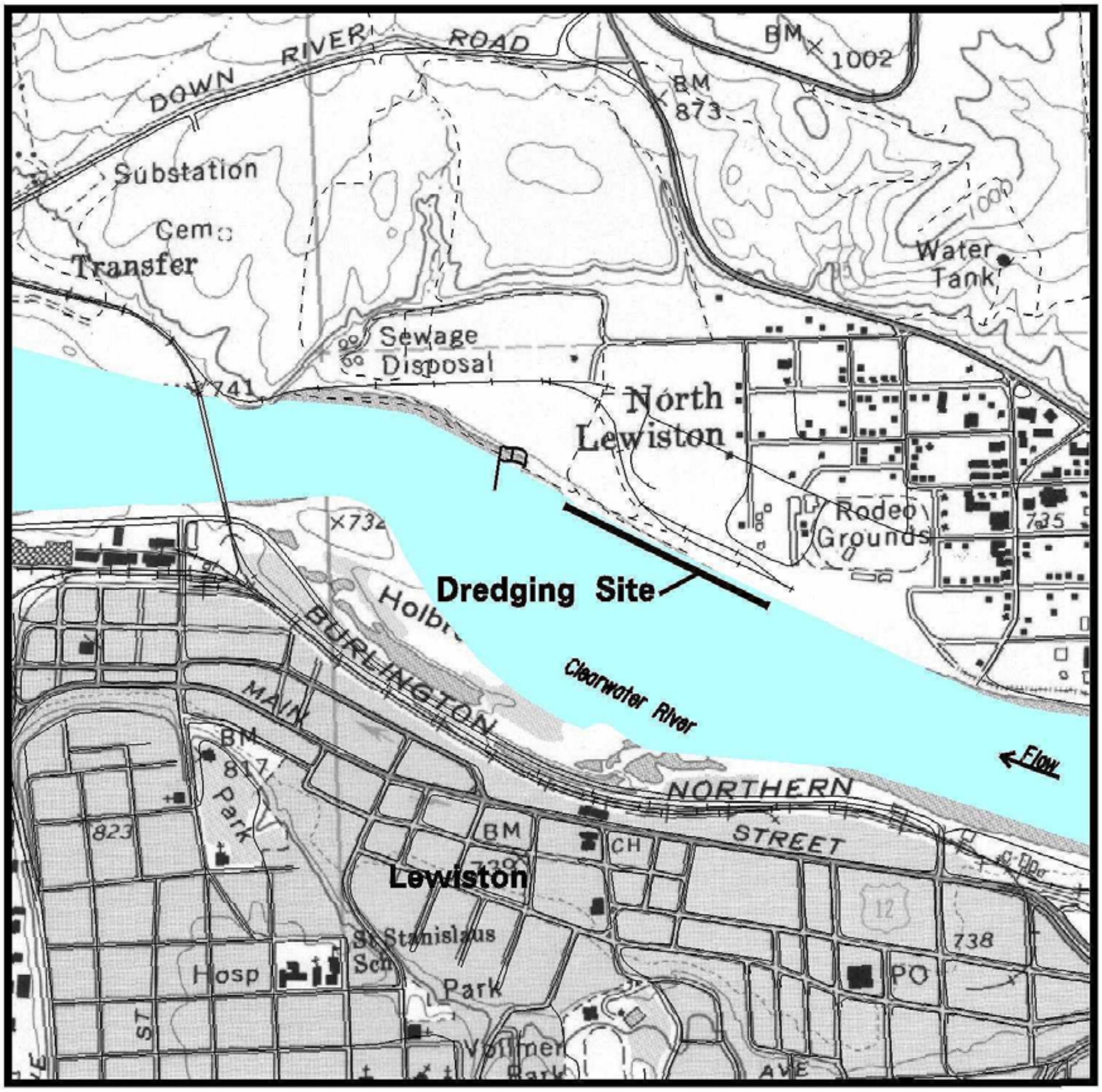

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Clarkston, WA. USGS 7.5 Minute Quadrangle, Township 11 N, Range 46 E.

Walla Walla District

Lower Snake River Reservoirs and McNary Reservoir Dredged Material Management Plan

Winter 2003-2004 Dredging Plan

PORT OF LEWISTON SITE

2002

Plate 3

GIS Analysis & Graphic Assembly: Applied Technology Team (CENWW-PM-PD-E-AT)
GIS Applications Coordinator: Bialse Grden (CENWW-PM-PD-E-AT)

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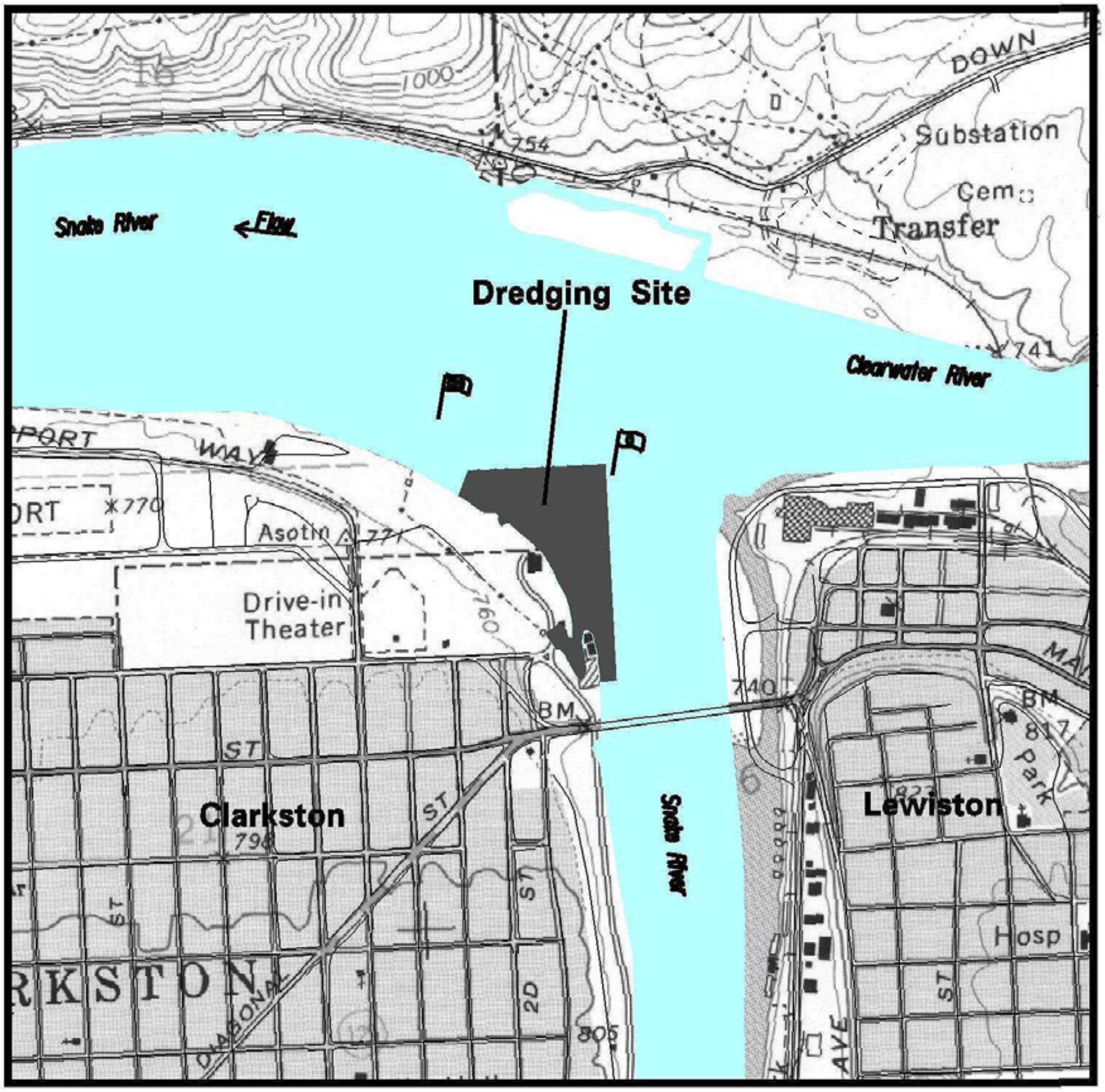

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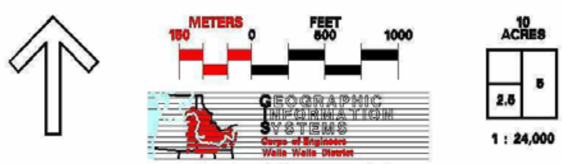

Clarkston, WA. USGS 7.5 Minute Quadrangle, Township 11 N, Range 46 E.

Walla Walla District
Lower Snake River Reservoirs and McNary Reservoir
Dredged Material Management Plan

Winter 2003-2004 Dredging Plan

GREEN BELT BOAT BASIN SITE

2002

Plate 4

GIS Analysts & Graphic Assembly: Applied Technology Team (CENWW-PM-PD-E-AT)
GIS Applications Coordinator: Bioise Green (CENWW-PM-PD-E-AT)

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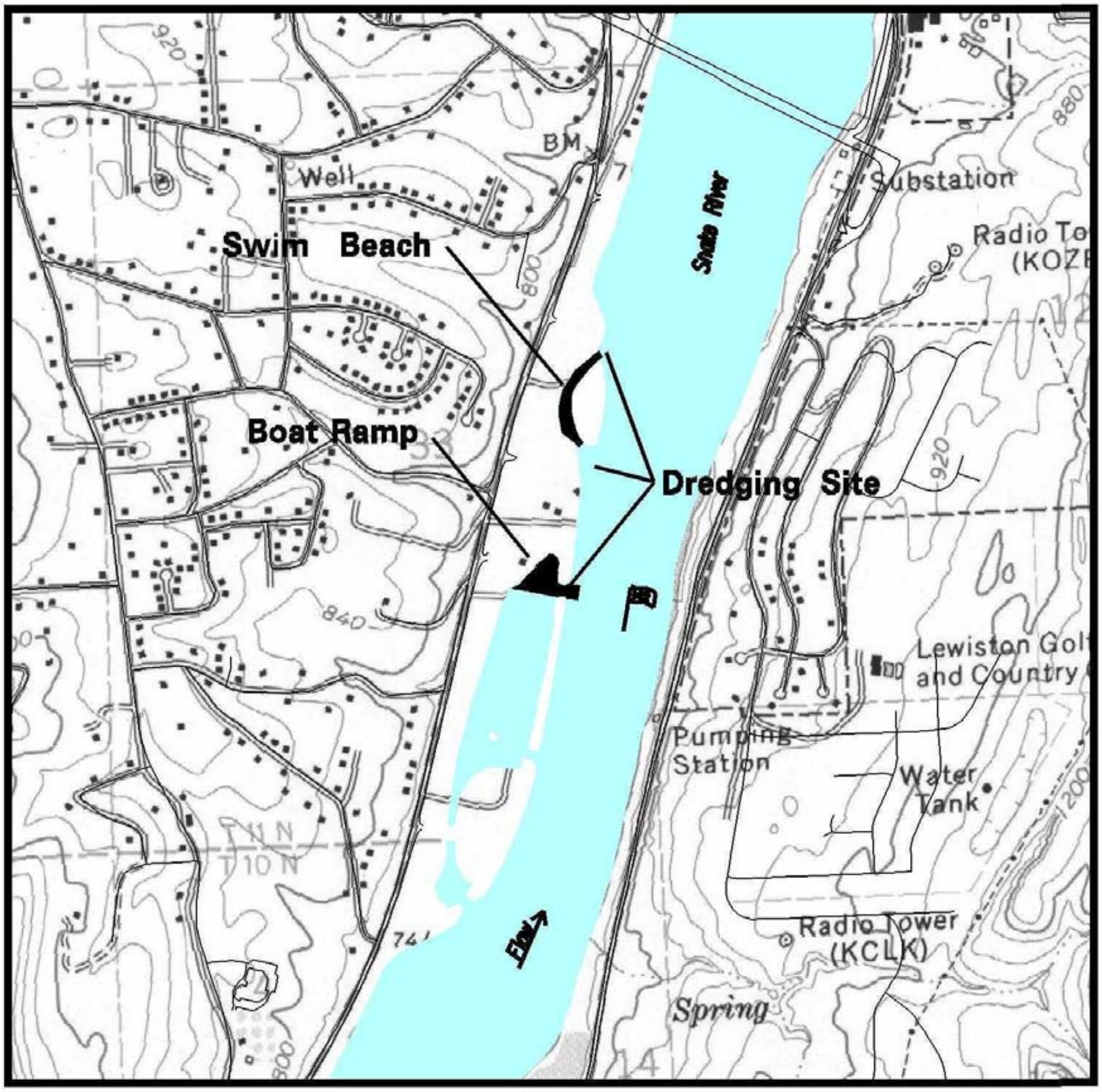

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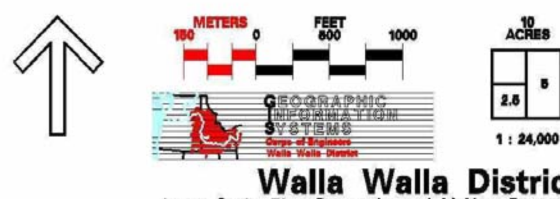

Clarkston, WA. USGS 7.5 Minute Quadrangle, Township 11 N, Range 46 E

Walla Walla District

Lower Snake River Reservoirs and McNary Reservoir Dredged Material Management Plan

Winter 2003-2004 Dredging Plan

SWALLOWS BEACH/ BOAT RAMP SITE

2002

Plate 5

GIS Analysts & Graphic Assembly: Applied Technology Team (CENWW-PM-PD-E-AT)
GIS Applications Coordinator: BiaIse Grden (CENWW-PM-PD-E-AT)

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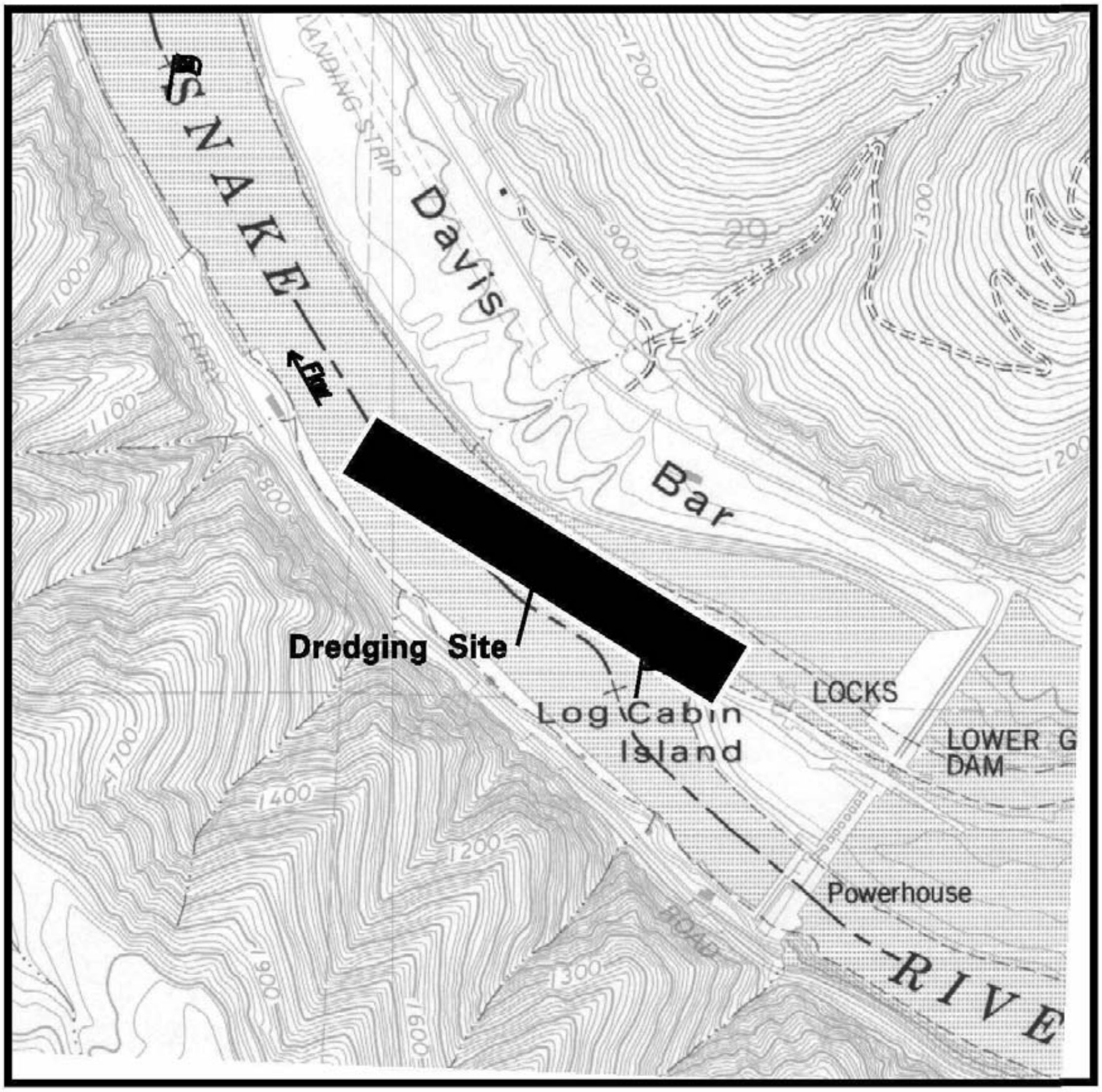

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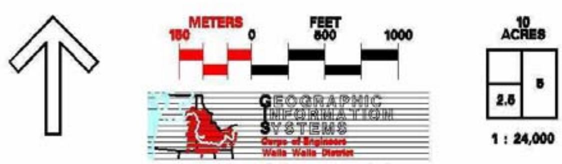

Almota, WA. USGS 7.5 Minute Quadrangle, Township 14 N, Range 43 E

Walla Walla District

Lower Snake River Reservoirs and McNary Reservoir Dredged Material Management Plan

Winter 2003-2004 Dredging Plan

LOWER GRANITE DAM NAVIGATION LOCK SITE

2002

Plate 6

GIS Analysts & Graphic Assembly: Applied Technology Team (CENWW-PM-PD-E-AT)
GIS Applications Coordinator: Blaise Grden (CENWW-PM-PD-E-AT)

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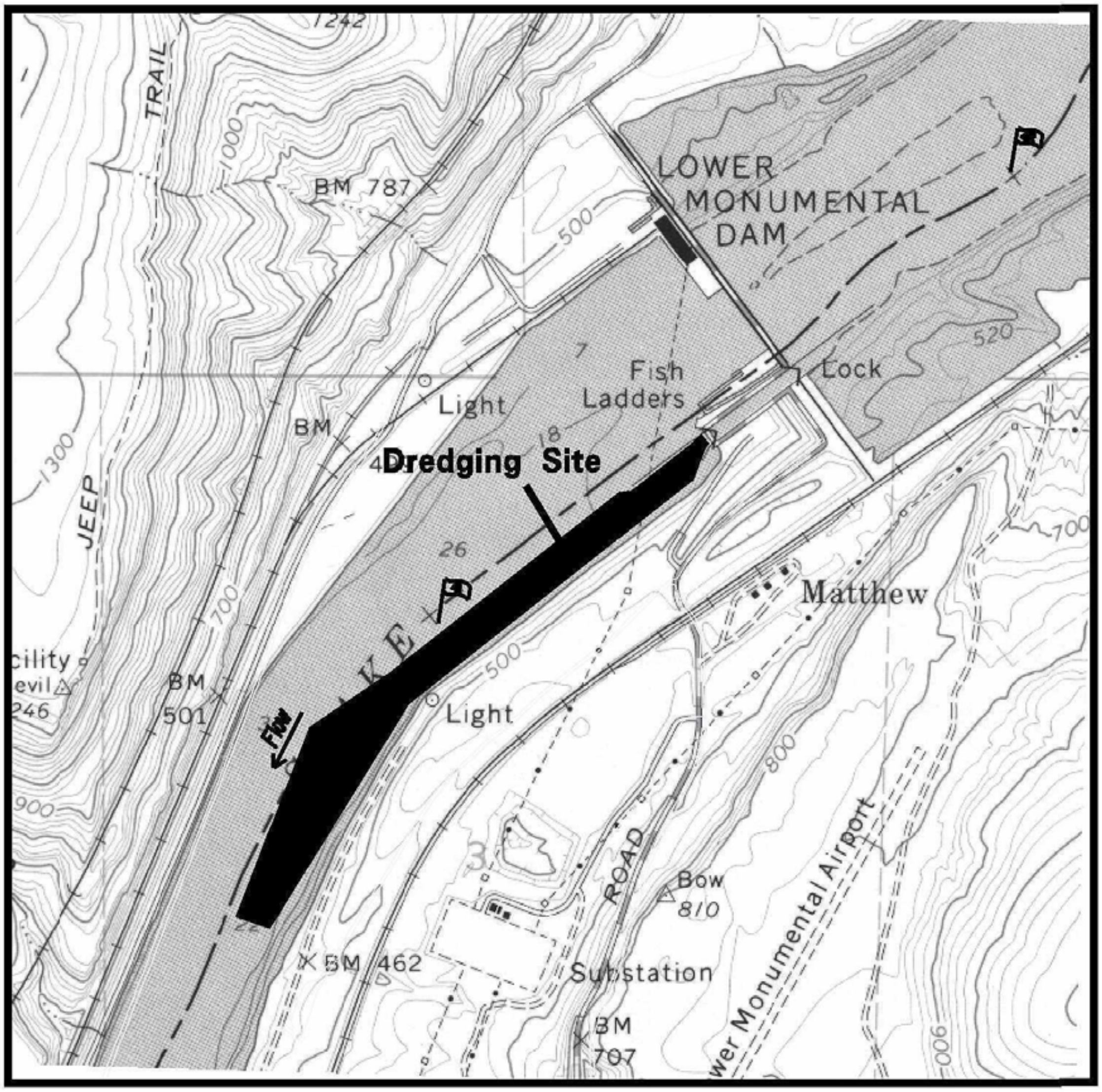

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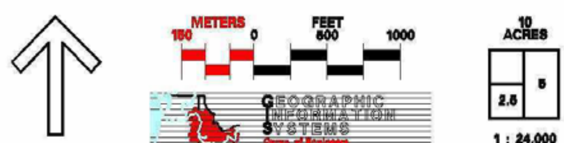

Lower Monumental Dam, WA. USGS 7.5 Minute Quadrangle, Township 12 N Range 34 E.

Walla Walla District
Lower Snake River Reservoirs and McNary Reservoir Dredged Material Management Plan
Winter 2003-2004 Dredging Plan

LOWER MONUMENTAL NAVIGATION LOCK SITE

2002

Plate 7

GIS Analysts & Graphic Assembly: Applied Technology Team (CENWW-PM-PD-E-AT)
GIS Applications Coordinator: BioTse Grden (CENWW-PM-PD-E-AT)

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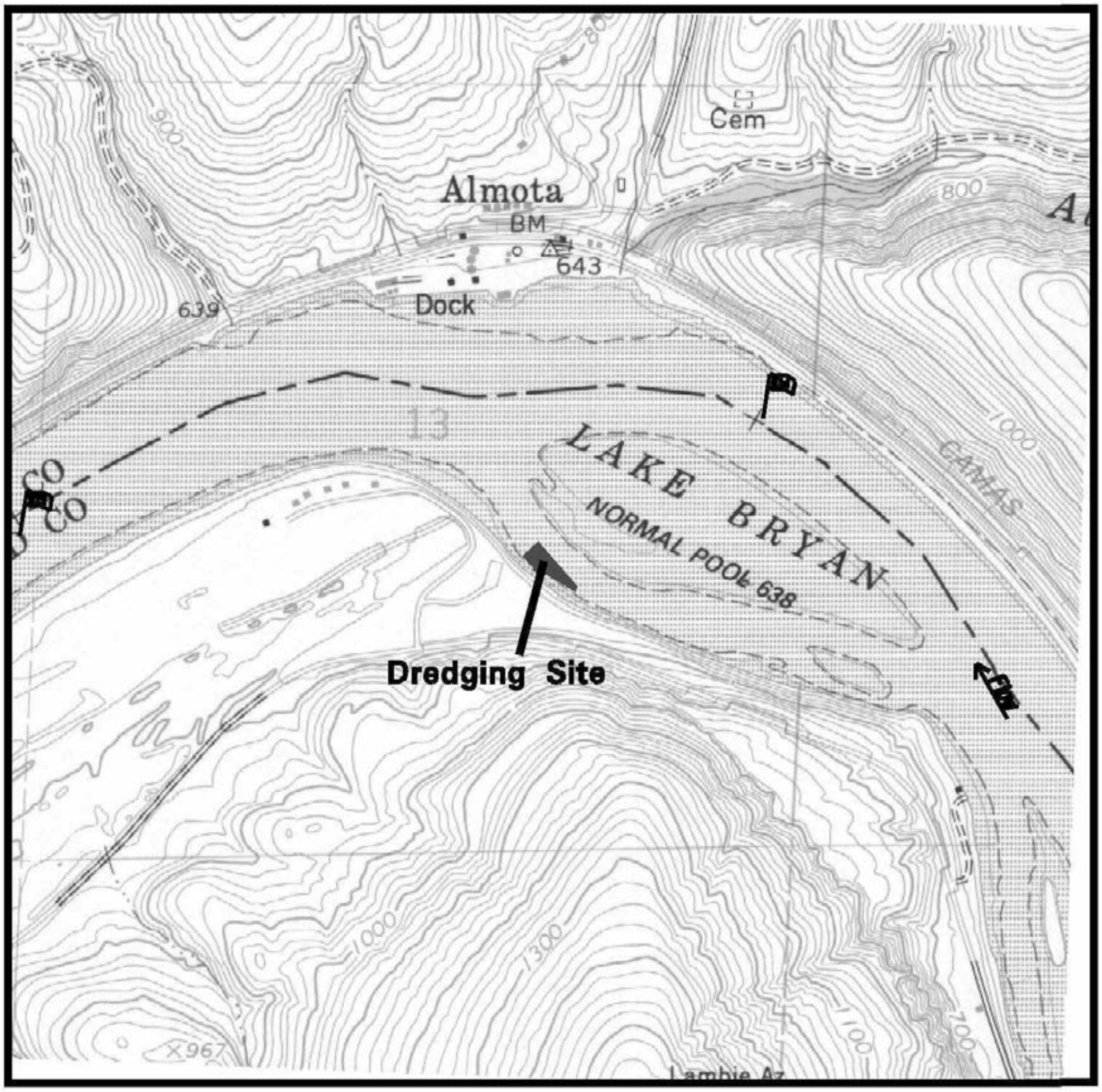
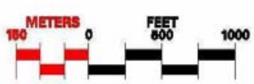
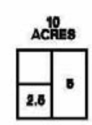


Sources:

Ice Harbor, Lower Monumental, Little Goose and Lower Granite Lock and Dams, Snake River, Clearwater River, Washingto and Idaho, Miscellaneous Dredging Sites, Dredging Plan, 13 Aug. 2000.





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Almota, WA. USGS 7.5 Minute Quadrangle, Township 14, Range 43 E.

Walla Walla District

Lower Snake River Reservoirs and McNary Reservoir Dredged Material Management Plan

Winter 2003-2004 Dredging Plan

ILLIA LANDING BOAT RAMP SITE

2002

Plate 8

GIS Analysts & Graphic Assembly: Applied Technology Team (CENWW-PM-PD-E-AT)
GIS Applications Coordinator: Bioise Groen (CENWW-PM-PD-E-AT)

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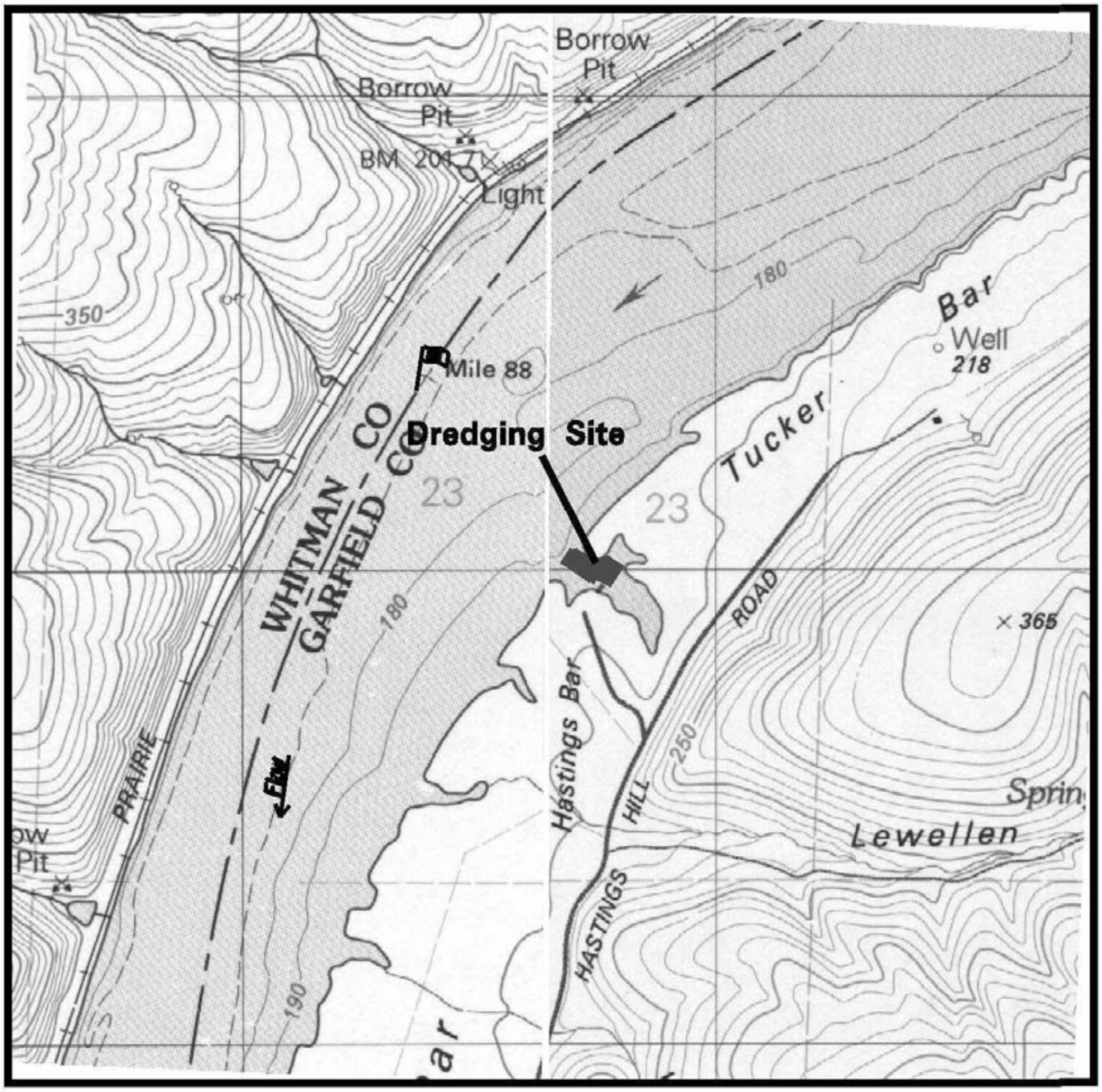

Sources:

Ice Harbor, Lower Monumental, Little Goose and Lower Granite Lock and Dams, Snake River, Clearwater River, Washingto and Idaho, Miscellaneous Dredging Sites, Dredging Plan, 13 Aug. 2000.

METERS 150 0 FEET 500 1000

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1 : 24,000

Geographic Information Systems
Corps of Engineers Walla Walla District

Central Ferry and Ping, WA. USGS 7.5 Minute Quadrangles, Township 14 N, Range 40 E.

Walla Walla District
Lower Snake River Reservoirs and McNary Reservoir Dredged Material Management Plan

Winter 2003-2004 Dredging Plan

WILLOW LANDING BOAT RAMP SITE

2002

Plate 9

GIS Analysis & Graphic Assembly: Applied Technology Team (CENWW-PM-PD-E-AT)
GIS Applications Coordinator: BioIse Green (CENWW-PM-PD-E-AT)

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Plates 10-11

The following plates are composites of figures 2, 3, and 11 for the Lower Granite tailrace; and, 4, 5, and 12 for the Lower Monumental tailrace. The original data from the potential spawning locations was not available in GIS format, so figures 11 and 12 were traced in a graphics program and extrapolated out using the proposed dredging template as a guide. While the Corps understands that this may not be an exact representation, the Corps also believes that it is a reasonable demonstration of the spawning habitat and dredging locations in the tailrace areas of the dams.

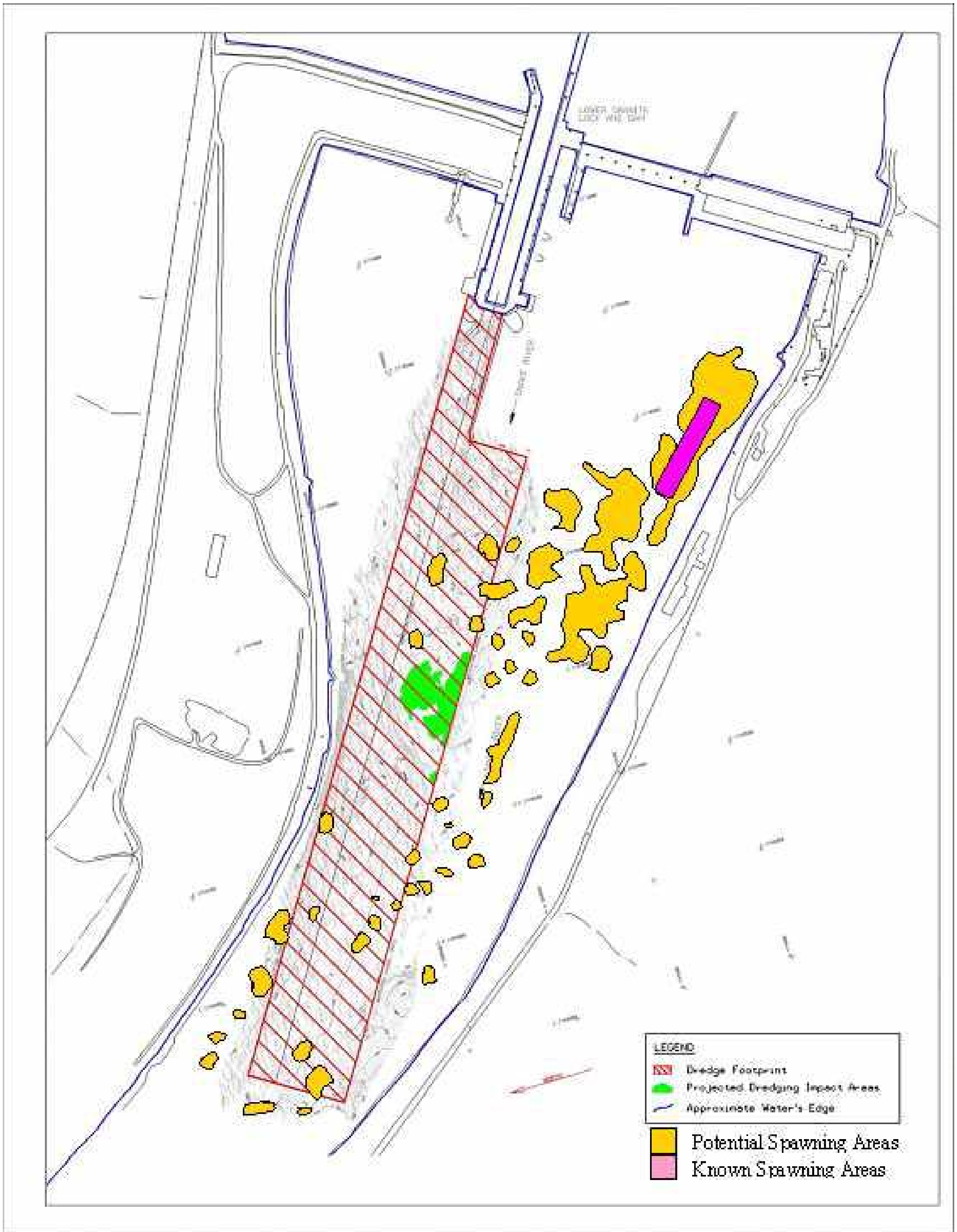

Plate 10 – Lower Granite tailrace composite representation of 2003-2004 proposed dredging area (green), Federal navigation channel (red), potential spawning areas (orange), and known spawning sites (pink).

Plate 11 – Lower Monumental tailrace composite representation of 2003-2004 proposed dredging area (green), Federal navigation channel (red), potential spawning areas (orange), and known spawning sites (pink).